Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 1 – Expressions, Equations, and Functions
Unit Title: Expressions, Equations, and Functions Course: Middle School Algebra I Brief Summary of Unit: In this unit students will learn the relationships between expressions, equations, and functions. In addition, students will use expressions, equations, and functions to model real-world situations. Textbook Correlation: Glencoe Algebra I Chapter 1 Sections 1,3,4,5,6,7, and 1.3 Lab Extension

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider...	*Students will understand that...*
• How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem?	• Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation.
• How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a	• Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies. • Concrete understandings in math lead to more

problem?	abstract understanding of math.

Transfer
Students will be able to independently use their learning to... analyze a complex problem in real life, breaking it down into smaller, sequential steps.

Meaning	
Essential Questions	Understandings
Students will consider... • How can different expressions represent the same situation? • What is the best expression to represent a situation? • What equation(s) represent a situation? • What does a solution mean in terms of a given situation? • Does the solution make sense in the context of the problem? • What determines when a relation is not a function?	*Students will understand that...* • Expressions are representations of real world situations. • There are multiple ways to determine a solution to an equation. • Math is a subject where prior knowledge and understanding is used to build more complex skills and problem solving. • Functions are relations where every input has exactly one output. • A vertical line is the only linear relationship that is not a function.

Acquisition	
Key Knowledge	Key Skills
Students will know... • Algebraic expressions (1-1) • Properties of equality (1-3) • Properties of real numbers (1-3) • Methods of Justification (1-3/1-4) • Distributive property (1-4) • Equations (1-5) • Range (1-6) • Relations (1-6) • Independent variable (1-6) • Dependent variable (1-6)	*Students will be able to....* • Construct an algebraic proof for a numerical expression (e.g. two-column proof, justify each step in simplifying) (1-3) • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities (1-3 extension) • Identify the domain and range of a relation and/or function (1-6/1-7) • Create input/output tables (1-6/1-7)

• Various ways to represent functions (1-6) • Definition of domain and its synonyms (*i.e.* independent variable, manipulated variable, input, and x) (1-6) • Definition of range and its synonyms (*i.e.* dependent variable, responding variable, output, and y) (1-6) • Mapping Diagram (1-6/1-7) • Functions (1-7) • Function notation (1-7) • Discrete functions (1-7) • Continuous functions (1-7)	• Create mapping diagrams (1-7) • Use a vertical line test to determine if a graph is a function (1-7)

Standards Alignment

N.Q.1
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N.Q.2
Define appropriate quantities for the purpose of descriptive modeling.

N.Q.3
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

A.SSE.1
Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P.

A. REI.3
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

8.EE.8
Analyze and solve pairs of simultaneous linear equations.
a. 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.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*
c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

A.REI.1
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step,

starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.CED.1
Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 2 – Linear Equations
Unit Title: Linear Equations Course: Middle School Algebra I Brief Summary of Unit: In this unit, students will learn to solve and construct equations to model real-world situations. Students will learn to solve multi-step linear equations, multi-step absolute value equations, and multi-step literal equations. Textbook Correlation: Glencoe Algebra I Chapter 2 Sections 1, 3, 4, 5, 8

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies.

• When is estimating the best solution to a problem?	• Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... analyze, solve and represent real-world problems using mathematical representations (numbers, operations, expressions, equations).

Meaning	
Essential Questions	Understandings
Students will consider... • What is the "best" way to solve an equation? • Can you defend your "best" way to solve an equation? How? • Why is solving literal equations for a particular variable helpful? • What is the best way to justify a solution? • Does the solution make sense in the context of the problem? • What is the best equation to represent a situation?	*Students will understand that...* • Just because an equation has a solution, does not necessarily mean the solution is a viable option in a real-world context. (For instance, if a function yields both a positive and a negative solution - the negative solution may have no real-world meaning.) • Manipulations to equations result in equivalent equations. • There are multiple ways to determine a solution to an equation. • A solution can be justified by a coherent argument.

Acquisition	Acquisition
Key Knowledge	Key Skills
Students will know... • Formulas (2-1)	*Students will be able to....* • Translate between equations and verbal sentences

• Inverse operations (2-3, 2-4) • Methods of justification • Algebraic Proofs • Extraneous solutions (2-5) • Unit conversions (2-8) • How to set up unit analysis conversions(2-8) • Unit analysis (dimensional analysis) (2-8)	(2-1) • Solve multi-step equations including variables on both sides and rational coefficients. (2-3/2-4) • Construct an algebraic proof for a simple equation (e.g. two-column proof, justify each step in solving an equation - use throughout entire chapter) • Solve equations involving absolute values (2-5) • Solve proportions which result in multi-step equations (2-6) • Solve and explain how to solve literal equations (2-8) • Analyze units of a problem to determine the steps and solution of the problem (2-8) • Use unit analysis to make conversions. (e.g. miles to feet, miles per hour to feet per second)(2-8)

Standards Alignment

N.Q.1
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N.Q.2
Define appropriate quantities for the purpose of descriptive modeling.

N.Q.3
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

A.SSE.1
Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of
their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P.

A. REI.3
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

8.EE.8
Analyze and solve pairs of simultaneous linear equations.
a. 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.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y*

cannot simultaneously be 5 and 6.
c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

A.REI.1
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.CED.1
Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 3 – Linear Functions
Unit Title: Linear Functions Course: Middle School Algebra I Brief Summary of Unit: In this unit students will use linear functions to solve real world problems graphically. They will represent patterns and sequences with tables, equations, and graphs. Textbook Correlation: Glencoe Algebra I Chapter 3 Sections 1, 2, 3, 5

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a problem?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies. • Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... notice patterns in the real-world and describe them using mathematical representations such as equations, tables, graphs, and functions.

Meaning	
Essential Questions	Understandings
Students will consider... • How can you represent and describe function? • What determines when a relation is not a function? • Which key feature(s) will best help interpret a problem? • What is the best way to describe a function or relation verbally? • What equation(s) represent a situation? • What does a solution mean in terms of a given situation? • Is a solution a viable solution to a problem? • How are linear functions and arithmetic sequences related?	*Students will understand that...* • There is a unique relationship between the input and output of a function. • Functions can represent real world situations. • A solution can be determined through analyzing a table, solving an equation or graphing a function. • A relationship exists between the roots of an equation and its graph. • Roots, zeroes, and x-intercepts all represent the solutions to a function or equation. • Tables, graphs, and equations are all representations of functions, each of which has its own purpose and benefit. • Arithmetic sequences are a mathematical representation that can be used to describe a linear pattern.

Acquisition	
Key Knowledge	Key Skills
Students will know... • x- and y-intercepts (3-1) • Standard form (3-1) • Constant (3-1) • Coefficient (3-1) • Roots (3-2) • Zeros (3-2) • Parent function/graph (3-2)	*Students will be able to...* • Determine if a relation or function is linear (3-1) • Create input/output tables (3-1) • Graph equations using intercepts (3-1) • Use function notation to represent functions (3-2) • Depict a graph of an equation with no solution (3-2) • Determine the rate of change of a linear function

• Linear functions (3-2) • Slope (3-3) • Rate of change (3-3) • Arithmetic sequence (3-5) • Initial value (3-5)	(3-3) • Find the slope given two ordered pairs, a table, or a graph (3-3) • Interpret the rate of change and the initial value as they relate to a situation (3-5) • Write a function relating two quantities. (3-5) • Write arithmetic sequences recursively and as an explicit formula. (3-5) • Use sequences to model real world situations. (3-5)

Standards Alignment

8.SP.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, and nonlinear association

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 assess the model fit by judging the closeness of the data points to the line.

8.SP.3
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height*

S.ID.6
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
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
and exponential models.
b. Informally assess the fit of a function by plotting and analyzing residuals.
c. Fit a linear function for a scatter plot that suggests a linear association.

F.BF.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific
values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

F.IF.4
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★

F.IF.5

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★

F.IF.6
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★

F.IF.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.9
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

8.F.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.

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.

A.CED.2
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 4 – Equations of Linear Functions
Unit Title: Equations of Linear Functions Course: Middle School Algebra I Brief Summary of Unit: Students will learn to write the equation of a line in slope-intercept form, point-slope form, and standard form. Students will evaluate which representations of a line is the most effective for a particular context. Students will also construct a scatterplot, determine a trend line for the scatterplot, and use a trend line to make predictions about the given data set. Textbook Correlation: Glencoe Algebra I Chapter 4 Sections 1, 2, 3, 4, 5, 7, 8

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies.

• When is estimating the best solution to a problem?	• Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... know that a linear equation/function can be written to model a real world situation.

Meaning	
Essential Questions	Understandings
Students will consider... • How does finding a line's slope by counting units of vertical and horizontal change on a graph, compare with finding it using a slope formula? • Given various equations, how would you determine which method you would prefer to use to graph the lines in the coordinate grid? • How would you write the equation of a line graphed on a coordinate plane? • What would you use to compare and contrast two linear equations and their graphs? • What is the best method for determining if two lines are parallel or perpendicular? • What are examples of real world data sets that could be represented on a scatter plot? • What are real-world situations (at least one with a positive correlation, at least one with a negative correlation, and at least one with no correlation) that could be represented on a scatter plot? • How can you make predictions given bivariate data?	*Students will understand that...* • There is a unique relationship between the input and output of a function. • Technology can be utilized to help investigate functions. • Equations can represent real world situations. The solution can be determined through solving or graphing and can be used to model the situation. • Slope shows a constant rate of change. • There are various methods for graphing a linear equation. • A line on a graph can be represented by a linear equation in various forms. • The relationship between two line can be determined by comparing their slopes and y-intercepts. • Two sets of numerical data can be graphed as ordered pairs. If the two sets of data are related, a line on the graph can be used to estimate or predict values in a real world situation.

Acquisition	
Key Knowledge	Key Skills

Students will know...	*Students will be able to....*
• Constant functions (4-1) • Slope intercept form (4-1, 4-2) • Point -slope (4.3) • Parallel and perpendicular lines (4-4) • Parallel lines have the same slope. (4-4) • Perpendicular lines have opposite reciprocal slopes. (4-4) • Bivariate data (4.5) • Scatterplots (4-5) • Trend line/Line of fit (4-5) • Clustering, outliers, positive association, negative association, nonlinear association. correlation coefficient (4-5) • Causation (4-5 lab) ***Line of best fit using technology will be implemented in unit 11	• Use technology to discover the effects of parameter changes. (4-1) • Use technology to graph linear functions (4-1) • Graph linear functions using various methods (i.e. slope-intercept, x-y table, point-slope) (4-1, 4-2, 4-3) • Create and identify parallel and perpendicular lines. (4-4) • Given an equation of a line or two points on a line and a point not on the line, write the equation of the line that is parallel to and is perpendicular to the given line. (4 - 4) • Construct a scatter plot (4-5) • Determine the relationship between bivariate data (4-5) • Recognize the relationship between bivariate data can be linear (4-5) • Use a model within the context of a situation (4-5) • Draw a trend line for a scatter plot (4-5) • Using function notation, write an equation that represents the trend line (4-5) • Interpret the meaning of slope and y-intercept for the trend line equation as it relates to a context (4-5) • Determine the meaning of slope and intercept in the context of a real world situation. (4-5)

Standards Alignment
8.SP.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, and nonlinear association .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 assess the model fit by judging the closeness of the data points to the line. 8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height* S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

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 and exponential models.
b. Informally assess the fit of a function by plotting and analyzing residuals.
c. Fit a linear function for a scatter plot that suggests a linear association.

F.BF.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

F.IF.4
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★

F.IF.5
Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★

F.IF.6
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★

F.IF.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.9
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

8.F.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.

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.

A.CED.2
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 5 - Inequalities
Unit Title: Inequalities Course: Middle School Algebra I Brief Summary of Unit: Students will solve multi-step inequalities and represent the solutions using set builder notation and on a number line. Students will graph bivariate inequalities on the coordinate plane to represent real world situations. Textbook Correlation: Glencoe Algebra I Chapter 5: Sections 1, 2, 3, 4, 5, 6

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies. • Concrete understandings in math lead to more

problem?	abstract understanding of math.

Transfer
Students will be able to independently use their learning to... use inequalities to describe real-world situations that have a range of values for solutions.

Meaning	
Essential Questions	Understandings
Students will consider... • How are solving linear inequalities similar to solving linear equations? • How can a real world situation be modeled by an inequality? • What is the "best" way to solve an inequality? • What is the "best" way to justify a solution? • What inequality(s) represent a situation? • What does a solution mean in terms of a given situation? • Is a solution a viable solution to a problem? Does the solution make sense? • What is the difference between using the words "and" and "or" in a mathematical sentence? • How are the properties of equality the same and different from the properties of inequality? • When should absolute value be used in the real world?	*Students will understand that...* • Manipulations to inequalities result in equivalent inequalities. • A solution can be justified by a coherent argument. • Inequalities represent real world situations. • There are various ways to determine a solution to an inequality. • To solve an inequality you isolate a variable. • Real world situations can be modeled with an inequality and can be solved like an algebraic inequality. • Inequalities have infinitely many solutions that satisfy the constraint of the problem • Single variable inequality solutions can be graphically represented by appropriately shading a number line. • Bivariate inequality solutions can be graphically represented by appropriately shading a coordinate plane. • Solving inequalities follows many of the same patterns as solving an equation.

Acquisition

Key Knowledge	Key Skills
Students will know... • Inequality (5-1) • Methods of justification (5-1, 5-2) • Properties of inequalities (5-1, 5-2) • Multi-step inequalities (5-3) • Compound inequalities (5-4) • Intersection (5-4) • Union (5-4) • Absolute value inequalities (5-5) • Boundary (5-6) • Closed half plane (5-6) • Open half plane (5-6)	*Students will be able to....* • Solve and explain how to solve inequalities (ch 5) • Determine equivalency of inequalities. (ch 5) • Justify the solution to an inequality .(ch 5) • Write the solution to an inequality using set builder notation. (ch 5) • Write one and two variable inequalities from given information. (ch 5) • Solve inequalities using multiple methods (e.g. graphing, algebraically, and tables). (ch 5) • Interpret solutions of inequalities based on the problem. (ch 5) • Determine whether a solution is reasonable. (ch 5) • Create and solve inequalities in one variable. (ch 5) • Solve real-world problems involving inequalities using multiple strategies. (ch 5) • Solve multi-step linear inequalities in one variable, including inequalities with coefficients represented by letters (5-3 HOTS) • Solve compound inequalities. (5-4) • Solve absolute value inequalities. (5-5) • Solve and graph inequalities in two variables. (5-6)

Standards Alignment

A. REI.3
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A.REI.12
Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

A.CED.1
Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions

A.CED.3
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 6 – Systems of Linear Equations
Unit Title: Systems of Linear Equations Course: 8th Grade Algebra 1 Brief Summary of Unit: Students will be able to solve systems of equations by graphing, substitution, and elimination. Students will learn to interpret the point of intersection of two graphs as meaningful in a given real world situation. Students will graph and solve systems of linear inequalities to represent real world situations. Textbook Correlation: Glencoe Algebra I Chapter 6, sections 1-6 and 6.1 Lab, 6.5 Lab, 6.6 Lab

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies.

• When is estimating the best solution to a problem?	• Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... know that systems of equations can be used to determine a break-even point that can be used to judge the most effective model for a given situation.

Meaning	
Essential Questions	Understandings
Students will consider... • What does a solution mean in terms of a given situation? • Is a solution a viable solution to a problem? Does the solution make sense? • What is the "best" way to solve a system of equations/inequalities? • Can you defend your "best" way to solve a system of equations/inequalities? How? • What is the most efficient method to determine the intersection point of two functions and/or relations? • How do you determine the number of real solutions for a system? • How many solutions does a system with various types of functions contain? • How are solutions of systems of equations or inequalities represented graphically? • How can solutions be derived using technology? • When is finding an approximate solution "good enough"? • What types of real-world situations can be solved using system of equations?	*Students will understand that...* • Systems of equations/inequalities represent real world situations. • There are various ways to determine a solution to a system of equations/inequalities. • Just because a system of equations has a solution, does not necessarily mean the solution is a viable option in a real-world context. (For instance, if a function yields both a positive and a negative solution - the negative solution may have no real-world meaning.) • Regardless of the type of system, the solution is still the intersection of the functions and/or relations. • When two functions or inequalities are graphed simultaneously, where they meet has meaning/context in an expression or an equation. • Systems of equations can have different types of solutions. • Systems of equations can be used to model real-world problems. • Sometimes an approximate solution is "good enough".

Acquisition	
Key Knowledge	Key Skills

Students will know...	*Students will be able to....*
• System of equations (6-1) • consistent(6-1) • inconsistent(6-1) • dependent(6-1) • independent(6-1) • Various methods of graphing (i.e. table of values, x- and y-intercepts, slope-intercept form, and point-slope form)(6-1) • The point of intersection is a solution of both linear equations(6-1) • How solutions are represented on a graph(6-1) • Parallel lines(6-1) • substitution(6-2) • elimination(6-3/6-4) • Systems of inequalities (6-6) What a solution means, including a no solution and infinite solutions (6-2/6-4) • Systems of Linear Inequalities (6-6)	• Solve systems of equations and inequalities using multiple methods (e.g. graphing, algebraically, tables, substitution, elimination, etc.)(chapter 6) • Graph two variable equations (6-1) • Estimate a solution to a system of linear equations using the corresponding graph of the equations (6-1) • Recognize there will be one solution, no solution, and infinitely many solutions (6-1) • Solve simple systems that lead to rational solutions. (6-1 / 6-2 / 6-4) • Check a solution for accuracy(6-2/6-3/6-4) • Find a solution to a set of equations using technology for exact or approximate solutions(6-1 Lab) • Graph functions using technology (i.e. graphing calculator, spreadsheet, software, etc.)(6-1 Lab/6-6 Lab) • Solve for one variable and use the substitution property to solve for the second variable (6-2) • To solve systems of equations by elimination (linear combinations)(6-3/6-4) • Manipulate equations to have like or opposite coefficients that will result in the elimination of a variable when the equations are added or subtracted(6-4) • Prove that solving systems of equations using linear combinations produces a system of equations with the same solutions.(6-4) • Write two variable equations from given information.(6-5) • Solve real-world problems that lead to systems of linear equations, using two variables(6-5) • Interpret solutions of equations and inequalities based on the problem(6-5 / 6-6) • Write two variable inequalities from given information(6-6) • Graph linear inequalities with two variables.(6-6)

Standards Alignment

8.EE.8
Analyze and solve pairs of simultaneous linear equations.
a. 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.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*
c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

A.REI.5
Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A.REI.11
Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★

A.REI.12
Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

A.REI.6
Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables

A.CED.3
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 7 – Exponents and Exponential Functions
Unit Title: Exponents and Exponential Functions Course: 8th Grade Algebra 1 Brief Summary of Unit: In this unit students will simplify and perform operations on expressions involving exponents, including using scientific notation. In addition, students will analyze data and represent situations involving exponential growth and decay using tables, graphs, or algebraic methods. Finally, students will relate geometric sequences to exponential functions, and write recursive formulas to represent sequences. Textbook Correlation: Glencoe Algebra I Chapter 7 sections 1, 2, 4, 5, 6, 7, 8

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider...	*Students will understand that...*
• How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be?	• Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies.

• When is estimating the best solution to a problem?	• Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... know that when encountering a real-world pattern that is growing very quickly or decaying very quickly an exponential function may best represent this pattern.

Meaning	
Essential Questions	Understandings
Students will consider... • When is it best to use an expression in expanded form versus condensed form? • Which form of an expression would be most useful - integral exponent or root format and why (rational exponents will be covered in unit 10)? • How can you determine limitations for various contextual situations? • How are geometric sequences similar to and different from exponential functions? • What are some real world situations that can be modeled using exponential growth? exponential decay? • How are linear and exponential functions similar and different?	*Students will understand that...* • Exponential expressions can be simplified using the exponent rules. • Simplifying expressions enables us to get a common understanding of the result. • Simplified expressions make working with algebraic expressions/equations easier. • Technology can be utilized to help investigate functions. • Situations can be modeled with exponential (constant percent rate) functions. • Contextual situations can have restricted domains and/or ranges. • Exponential growth and decay have greater rates of change than other models. • Geometric sequences can be used to describe patterns that grow and decay exponentially.

Acquisition	
Key Knowledge	Key Skills
Students will know...	*Students will be able to....*

• Monomial (7-1) • Power of a power rule (7-1) • Powers with the same base (7-1) • Dividing powers with the same base (7-2) • Power of a quotient (7-2) • Integral exponents (7-2) • Scientific notation (7-4) • Identify key characteristics of a graph (intercepts, end behavior, domain, and range) (7-5) • End behavior of a graph (7-5) • Given contextual situations, there may be limitations on domain and range (7-5) • Exponential growth (7-5 / 7-6) • Exponential decay (7-5/ 7-6) • Geometric sequences (7-7) • $\frac{f(x)-f(a)}{x-a}$ (7-7) • Recursive process (7-8) • Explicit expression (7-8)	• Apply multiplication properties of exponents (7-1) • Apply division properties of exponents (7-2) • Apply exponential properties with scientific notation. (7-4) • Convert standard form to scientific notation and vice versa (7-4) • Graph exponential functions. (7-5) • Use technology to graph linear and exponential functions. (7-5 Lab) • Determine whether exponential functions represent growth or decay. (7-5) • Apply exponential properties to exponential functions. (7-5, 7-6) • Apply exponential properties to exponential functions. (7-5, 7-6) • Describe situations where a quantity grows or decays at a constant percent rate per unit interval as compared to another. (7-6) • Solve and explain how to solve a linear & literal equations, as well as inequalities to include simple exponential equations that only rely on the application of the laws of exponents. (7-6 Lab) • Calculate average rate of change of exponential functions. (7-7 Lab) • Given contextual situations, there may limitations on the domain and range. (7-6) • Recognize and determine sequence patterns with an emphasis on those that can be represented recursively (arithmetic, geometric, Fibonacci). (7-7) • Calculate average rate of change of exponential functions.(7-7 lab) • Write geometric sequences both recursively and as an explicit formula. (7-7, 7-8) • Translate between recursive to explicit format. (7-8) • Combine two different function types to model a situation. (7-8)

Standards Alignment
N.RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example we define* $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $(5^{\frac{1}{3}})^3=(5^{\frac{1}{3}})^3$ *to hold, so* $(5^{\frac{1}{3}})^3$ *must equal 5.*

N.RN.2
Rewrite expressions involving radicals and rational exponents using the properties of exponents.

A.SSE.1
Interpret expressions that represent a quantity in terms of its context.★
. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of
their parts as a single entity. For example, interpret $P(1+r)^n$
as the product of P and a factor not depending on P.

A.SSE.3
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★
c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

F.IF.8
Write a function defined by an expression in different but equivalent forms to reveal and
explain different properties of the function.
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*

F.LE.1
Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.LE.2
Construct linear and exponential functions, including arithmetic and geometric sequences,
given a graph, a description of a relationship, or two input-output pairs (include reading these from a table.)

F.BF.2
Write arithmetic and geometric sequences both recursively and with an explicit formula; use them to model situations, and translate between the two forms. (★

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 8 - Polynomials
Unit Title: Middle School Algebra I Course: Polynomials Brief Summary of Unit: Students will be able to add, subtract, and multiply polynomials. In addition, students will be able to factor as necessary in problem situations. Finally, students will solve quadratic equations using concrete models, tables, graphs, and algebraic methods. Textbook Correlation: Glencoe Algebra I Chapter 8 Sections: 1, 2, 3, 4, 5, 6, 7, 8, & 9

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a problem?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving strategies.

	• Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... apply algebraic processes to simplify and solve complex problems in the real world.

Meaning	
Essential Questions	Understandings
Students will consider... • Why is it important to simplify and evaluate polynomial expressions? • When is it necessary to use polynomials? • What operation on a set of polynomials would best create a useful expression for a given situation? • What is the best way to factor this expression? • Why is it possible for a quadratic equation to have two solutions? • How is it possible for a quadratic equation to have two solutions, but in a real-world context only have one solution?	*Students will understand that...* • Monomials can be used to form larger expressions called polynomials • Polynomials can be useful to represent various situations. • Simplifying like terms is more useful when working with polynomials. • Polynomials can be added, subtracted and multiplied to form equivalent expressions. • Factoring polynomials follows the same rules as factoring a number. • There are multiple strategies that can be used to attempt factoring polynomials. • Factoring can be used to simplify a larger polynomial expression. • Factoring is one strategy that can be used to solve quadratic equations. • Quadratic equations have two solutions, one solution, or no solutions. • Some solutions to a quadratic equation are not feasible in a real world context.

Acquisition	
Key Knowledge	Key Skills
Students will know... • Polynomials (8-1)	*Students will be able to....* • Add and subtract polynomials (8-1)

• Monomials (8-1) • Binomials (8-1) • Trinomials (8-1) • Degree of a Polynomial (8-1) • Leading Coefficient (8-1) • Standard form of a polynomial (8-1) • Closure property (8-1) • FOIL method of multiplying (8-3) • Quadratic Expression (8-3) • Perfect square trinomials (8-4/8-9) • Difference of Squares (8-4/8-8) • Factoring (8-5) • Factoring by grouping (8-5) • Zero product property (8-5) • Prime polynomial (8-7)	• Develop an informal argument that polynomials are closed under addition, subtraction, and multiplication. (8-1) • Identify the terms, factors, and coefficients of an expression (8-1) • Multiply polynomials (8-2) • Apply properties of exponents to polynomials (8-2) • Multiply binomials by binomials, binomial by trinomial, trinomial by trinomial, multiplying a monomial by any degree polynomial (8-3 / 8-4) • Factor polynomials by finding GCF (8-5) • Solve equations of the form $ax^2 + bx = 0$. • Factor polynomials of the form, $x^2 + bx + c$ • Solve equations of the form, $x^2 + bx + c = 0$ using factoring(8-6) • Solve equations of the form $ax^2 + bx + c = 0$, using factoring. • Factor expressions in quadratic form $(x^4 - y^4) = (x^2)^2 - (y^2)^2$ or $x^4 - 3x^2 - 10 = (x^2 - 5)(x^2 + 2)$ (8-8) • Factor binomials which are a difference of two squares (8-8) • Solve quadratic equations that follow the difference of squares factoring pattern. • Factor polynomials that follow the perfect squares pattern. • Solve real-world problems using quadratic equations using multiple strategies. (ch 8)

Standards Alignment

A.APR.1
Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials

A.SSE.1
Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.

CCSS MP.1 Make sense of problems and persevere in solving them.
CCSS MP.2 Reason abstractly and quantitatively.
CCSS MP.3 Construct viable arguments and critique the reasoning of others.
CCSS MP.4 Model with mathematics.
CCSS MP.5 Use appropriate tools strategically.
CCSS MP.6 Attend to precision.
CCSS MP.7 Look for and make use of structure.

CCSS MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 9 – Quadratic Functions and Equations
Unit Title: Middle School Algebra I Course: Quadratic Functions and Equations Brief Summary of Unit: In this unit students will be able to solve quadratic equations by graphing, completing the square, and using the Quadratic Formula. In addition, students will solve real world problems using quadratic equations and their graphs. Finally, students will analyze a data set to determine if a linear model, quadratic model, or exponential model best fits the given context. Textbook Correlation: Glencoe Algebra I Chapter 9 Sections: 1, 1 lab, 2, 3, 3 lab, 4, 4 lab, 5, 6

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a problem?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving

	strategies. • Concrete understandings in math lead to more abstract understanding of math. • Successive differences in the independent variable cause changes in dependent variable that can be related to linear, exponential and quadratic functions.

Transfer
Students will be able to independently use their learning to... know that there are real-world patterns and problems that are best modeled with quadratic functions.

Meaning	
Essential Questions	Understandings
Students will consider... • Which method of solving a quadratic equation is most efficient? And why? • How do the roots of a quadratic equation relate to a real world situation? • What does the maximum or minimum represent in a real-world context? • When would technology be useful in comparing functions? • How is a transformed function related to its parent function? • When is it useful to have a quadratic equation written in vertex form? • How is the quadratic formula derived and why is it useful? • How is it possible for a quadratic equation to have two solutions, one solution or no solutions? • How are solutions of quadratic equations, zeroes of quadratic functions, and horizontal intercepts of	*Students will understand that...* • Technology can be utilized to help investigate functions. • Various representations of the same function emphasize different characteristics of the quadratic function. • A quadratic equation can be written into other forms, including vertex form. • The quadratic formula is derived by completing the square. • Some quadratic equations only have complex solutions. • Parent functions can be transformed in several ways. • Quadratic equations can have two solutions, one solution, or no solution. • There is a connection among the solutions (roots) of quadratic equations, the zeroes of their related functions, and the horizontal intercepts

a graph connected? • What is the best way to determine if a data set is linear, quadratic or exponential?	of the graph of the function.

Acquisition	
Key Knowledge	Key Skills
Students will know... • Quadratic function (9-1) • Parabola (9-1) • Axis of symmetry (9-1) • Minimum value (9-1) • Maximum value (9-1) • Vertex (9-1) • Intervals of increasing and decreasing behaviors (9-1) • End behavior (9-1) • Axis of symmetry (9-1) • Standard form of quadratic equations (9-1) • Average Rate of Change • $\frac{f(x)-f(a)}{x-a}$ • Double roots (9-2) • Effect of 1 parameter change (vertical translations, horizontal translations, reflection over x-axis, vertical stretch, vertical shrink) of quadratic functions (9-3) • Vertex Form (9-3) • Completing the square (9-4) • Quadratic Formula (9-5) • Discriminant (9-5) • Successive differences ((with consecutive changes in the domain, notice the type of change in the range) (9-6)	*Students will be able to....* • Analyze the characteristics of graphs of quadratic functions (9-1) • Find minimum, maximum, end behavior, symmetries, intercepts, and intervals of increasing and decreasing behaviors (9-1) • Identify and describe the domain of a function in a real world situation (9-1) • Graph a quadratic function using an x-y table and characteristics of quadratic functions (9-1) • Interpret slope as the rate of change (using a table and/or a graph) over a specific interval (9-1 lab) • Sketch a graph of a quadratic function showing key features (9-2) • Use factoring to find zeroes of a quadratic function (9-2) • Solve quadratic functions by graphing (9-2) • Based on the parent quadratic function, graph a single transformation of each type (translation, reflection, or dilation) (9-3) • Analyze the vertex form of a quadratic function to determine the transformation of the parent graph (9-3) • Solve a simple system, in two variables, that contains one linear and one quadratic equation graphically. (9.3 Lab) • For more complex situations, use a calculator to graph and analyze various types of functions (9-3 lab) • Find the minimum and maximum value by completing the square (9-4) • Solve a quadratic equation by completing the square (9-4) • Solve quadratic functions by using the quadratic formula (9-5) • Find the number of solutions to a quadratic equation by using the discriminant (9-5) • Find minimum, maximum, end behavior,

	intercepts, and intervals of increasing and decreasing behaviors (9-4 lab) • Analyze data to determine if the change in domain and range is linear, exponential, or quadratic using successive differences (9-6) • Explain the zeroes, extreme values, and symmetry of a graph in terms of a given context (ch. 9) • Solve real-world problems that can be modeled with quadratic functions using multiple strategies.

Standards Alignment

A.SSE.3
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★
a. Factor a quadratic expression to reveal the zeroes of the function it defines.
b. Complete the square in quadratic expression to reveal the maximum and minimum value of the function it defines.

F.IF.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
a. Graph quadratic functions and show intercepts, maxima, and minima.
b. Graph piecewise-defined functions, including step functions and absolute value functions.

F.IF.8
Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
a. Use the process of completing the square in a quadratic function to show zeroes, extreme values and symmetry of the graph, and interpret these in terms of a context.

F.IF.9
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

A.REI.4
Solve quadratic equations in one variable.
a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

F.LE.1
Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.IF.6
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★

CCSS MP.1 Make sense of problems and persevere in solving them.
CCSS MP.2 Reason abstractly and quantitatively.
CCSS MP.3 Construct viable arguments and critique the reasoning of others.
CCSS MP.4 Model with mathematics.
CCSS MP.5 Use appropriate tools strategically.
CCSS MP.6 Attend to precision.
CCSS MP.7 Look for and make use of structure.
CCSS MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 10 – Radicals and Radical Expressions
Unit Title: Radicals and Radical Expressions Course: Middle School Algebra 1 Brief Summary of Unit: In this unit students will be able to extend the properties of integral exponents to rational exponents. Students will also be able to perform operations and simplify radical expressions. In addition, students will analyze and graph square root functions and use them to solve real world problems. Finally, students will be able to solve radical equations and solve real world problems involving the Pythagorean Theorem. Textbook Correlation: Glencoe Algebra I Chapter 7, section 3 and Chapter 10, sections 1, 2, 2 lab, 3, 4, 5, *****supplement to address A.CED.4**

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving

• How accurate do I need to be? • When is estimating the best solution to a problem?	strategies. • Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... know that there are real world patterns and problems that can be modeled with square root functions. apply the Pythagorean Theorem and its converse in a real world situation (e.g. to make sure you have square corners, etc.)

Meaning	
Essential Questions	Understandings
Students will consider... • How is a transformed function related to its parent function? • Why are transformations of graphs the same regardless of the type of function? • How can functions be compared if they are in different formats? • When would technology be useful in comparing functions? • What are similarities and differences between two graphs? • How can you determine limitations for various contextual situations? • Which representation (rational exponents or radical) is best for a given situation? • When and why are expressions simplified? • Which form of an expression would be most useful: rational exponent or root format and why? • When is it more appropriate to use simplified radical expression rather than its decimal approximation? • What are appropriate applications of the Pythagorean Theorem in real world contexts?	*Students will understand that...* • Transformations of functions can be an effective tool to graph and describe functions efficiently. • The location of a constant in the equation of a function affects the graph in specific ways. • Regardless of the parent function, functions can be transformed in similar ways • Functions in different formats can be compared to identify information for interpretation. • Technology can be utilized to help investigate functions. • Contextual situations can have restricted domains and/or ranges. • The Pythagorean Theorem can be used in multiple real world settings • Exponential expressions can be represented as radical expressions and vice versa. • A simplified radical expression is more precise than a decimal estimate.

Acquisition	
Key Knowledge	Key Skills
Students will know... • square root functions (10-1) • radicand (10-1) • rationalize the denominator(10-2) • properties of rational and irrational numbers(10-2) • properties of simplifying radicals(10-2) • difference between a rational and irrational number(10-2) • the sum or product of two rational numbers is rational(10-2 lab) • the sum of a rational number and an irrational number is an irrational number(10-2 lab) • operations with radical expressions(10-3/10-4) • Rational exponent (7-3) • Radicals (7-3) • Square roots (7-3) • Cube roots (7-3) • extraneous solutions(10-4) • Pythagorean Theorem and its converse(10-5)	*Students will be able to....* • graph square root functions(10-1) • compare transformations of square root functions to parent functions(10-1) • determine the effect of changing the value of a constant in an equation(10-1) • Interpret the meaning of each part of an expression as well as the entire expression (i.e. how does -2 in $y = \sqrt{x-2}$ affect the domain) (10-1) • analyze radical functions of real world examples (10-1) • use inductive reasoning (examination of several examples) to show the sum or product of two rational numbers is rational (10-2) • Simplify by rationalizing the denominator(10-2) • use inductive reasoning to show the sum of a rational number and an irrational number is irrational(10-2 / 3-5 lab-inductive reasoning) • simplifying radical expressions(10-2) • perform and simplify the four basic operations with radical expressions (10-2/10-3/10-4) • Apply the properties of exponents using rational exponents. (7-3) • Convert fractional exponents into radical expressions (Example: $5^{\frac{2}{3}} = \sqrt[3]{5^2}$) and Vice versa. (7-3) • Compare and contrast integer exponents and rational exponents and the rules that apply to them. (7-3) • Convert from root form to rational exponent form. (7-3) • Convert from root form to rational exponent form. (7-3) • Solve and explain how to solve linear and literal equations, as well as inequalities, to include simple exponential equations that only rely on the application of the laws of exponents (7-3) • solve radical equations(10-4) • analyze solutions to recognize extraneous solutions (10-4) • Find the missing leg or hypotenuse of a right triangle using the Pythagorean Theorem(10-5) • Apply the Pythagorean Theorem to real world problems(10-5)

	• Prove the Pythagorean Theorem and its converse (10-5) • Use the Pythagorean Theorem to find the distance between two points on a coordinate plane(10-5) • Solve literal equations for an indicated variable, where the variable is of degree 1 or 2(10-5, supplement)

Standards Alignment

F.BF.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

F.IF.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

8.G.6 Explain a proof of the Pythagorean theorem and its converse.

8.G.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.8 Apply the Pythagorean theorem to find the distance between two points in a coordinate system.

N.RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example we define* $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $(5^{\frac{1}{3}})^3=(5^{\frac{1}{3}})^3$ *to hold, so* $(5^{\frac{1}{3}})^3$ *must equal 5.*

N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

N.RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V =IR to highlight resistance R.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 11 – Data Analysis
Unit Title: Data Analysis Course: Middle School Algebra I Brief Summary of Unit: In this unit students will use scatter plots and lines of fit, and write equations of best-fit lines using linear regression. In addition, students will determine the effect that transformations of data have on measures of central tendency and spread. Furthermore, students will compare data sets using measures of central tendency and spread. Students will be able to summarize and interpret data recorded in a two way frequency table. Textbook Correlation: Glencoe Algebra I Chapter 4 Sections 5 & 6 ; Chapter 12 Sections 2, 3, 4, 7 Lab

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving

• How accurate do I need to be? • When is estimating the best solution to a problem?	strategies. • Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... create, analyze, and interpret graphs that display univariate and bivariate data sets. use measures of center and spread to compare data sets and determine which data set best represents a situation.

Meaning	
Essential Questions	Understandings
Students will consider... • Given a data set, what is the best measure of center, measure of spread and data plot to use (box plot, dot plot or histogram)? Why? • How can you use a two-way frequency table to analyze data? • What determines if a model is a good fit to a set of real world data? • When is it appropriate to use a trend line versus a line of best fit? • How can statistics be used to mislead? • How do you know if is there an association between two sets of data? • Why is it important to know if there is an association between sets of data? • When is the relationship between bivariate data nonlinear? linear? • Why is it important to know how closely a model fits a particular set of data?	*Students will understand that...* • Data (with and without outliers/extreme values) can be represented using various types of measures (center and spread) • Some data plots are better descriptors of the data than others (box plots, line plots, etc.) • Two way tables allow you to determine patterns and associations in data sets. • Some real world data can be represented by a linear model and the parameters in the model have meaning in terms of the situation. • Some models are better fit to the data given. • Correlation does not always mean there is causation. • Categorical or quantitative data can present associations (pattern) and those associations can be used to make observations about the data in context. • Writing equations of lines is similar to writing the least squares regression line. • Linear models increase or decrease by the same constant, we call that constant the slope. • Linear models can be constructed for any set of data; however it is necessary to judge how good

	a fit the model is to the data set. • Technology is an efficient tool for determining a linear model and its goodness of fit.

Acquisition	
Key Knowledge	Key Skills
Students will know... • Bimodal (12-3) • Symmetric (Bell Curve) (12-3) • Skewed (12-3) • Uniform (12-3) • Bell Curve (12-3) • Standard deviation (12-2) • Outlier (extreme values) (12-3) • Two-way frequency table (12.7 Lab) • Joint frequency (12.7 Lab) • Marginal frequency(12.7 Lab) • Conditional relative frequency (12.7 Lab) • Correlation coefficient (4.5 Lab) • Causation (4.6) • Difference between a trend line and a line of best fit (4.6) • Bivariate data (4.6) • Scatterplots (4.6) • Line of Best Fit (4.6) • Least Square of the Residuals (4.6) • Residual - The residual in a regression model is the difference between the observed and the predicted y for some x (x the • Dependent variable and y the independent variable). (4-6) • Clustering (4-5) • Outliers (4-5) • Positive correlation (4-5) • Negative correlation (4-5) • Nonlinear correlation (4-5)	*Students will be able to....* • Represent data on a dot plot, histogram and a box plot (12-3 and 12-4) • Compare sets of data based on the measure of center, measure of spread and data plots as they relate to various contexts with and without extreme values (12-4) • Utilizing the shape of a set of data determine what that says about the measures of center and measures of spread (12-3) • Construct and interpret a two-way frequency table (12-7 Lab) • Using joint, marginal and conditional relative frequencies, determine if there is an association between two categories given a two-way frequency table (12-7 Lab) • Utilize technology to determine the least squares regression line (line of best fit) and correlation coefficient (4-6) • Distinguish between correlation and causation (4-5 Lab) • Determine the meaning of slope and intercept in the context of a real world situation (4-6) • Interpret the meaning of a correlation coefficient (4-6) • Use the correlation coefficient to determine if a particular linear model is a good fit (4-6) • Determine the relationship between bivariate data (4-5) • Recognize the relationship between bivariate data can be linear or exponential (4-5) • Use a model within the context of a situation (12-3 / 12-4) • Using function notation, write an equation that represents the line of best fit (4.6) • Interpret the meaning of slope and y-intercept for

	the line of the best fit equation as it relates to a context (4.6) • Use residuals to determine if a model is a good fit or not (4.6) • Write the equation of the least squares regression line (this is the new name for "line of best fit") if there is a linear association (4.6) • Use technology to construct scatterplots, determine a linear model, and determine the goodness of fit of a linear model. (4.6)

Standards Alignment

S.ID.7
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S.ID.8
Compute (using technology) and interpret the correlation coefficient of a linear fit.

S.ID.9
Distinguish between correlation and causation.

8.SP.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, and nonlinear association

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 assess the model fit by judging the closeness of the data points to the line.

8.SP.3
Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

8.SP.4
Understand that patterns of association can also be seen in bivariate categorical data displaying 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 two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

S.ID.1
Represent data with plots on the real number line (dot plots, histograms, and box plots).

S.ID.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.

S.ID.3
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S.ID.5
Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S.ID.6
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
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 and exponential models.
b. Informally assess the fit of a function by plotting and analyzing residuals.
c. Fit a linear function for a scatter plot that suggests a linear association.

N.Q.1
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N.Q.2
Define appropriate quantities for the purpose of descriptive modeling.

N.Q.3
Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:

Math 1, 4, 5

Wentzville School District
Curriculum Development Template
Stage 1 – Desired Results

Unit 12 – Functions Revisited
Unit Title: Middle School Algebra I Course: Functions Revisited Brief Summary of Unit: In this unit students will review the features of various functions. Students will be able to recognize and utilize the similarities between linear, quadratic, exponential, piecewise, and step functions to solve problems. Finally, students will solve systems of equations involving more than one type of function. Textbook Correlation: Glencoe Algebra I Chapter 1 Section 8, Chapter 9 Sections: 1, 1 lab, 2, 3, 3 lab, 4, 4 lab, 5, 6, 7 and 7 lab

WSD Overarching Essential Question	WSD Overarching Enduring Understandings
Students will consider... • How do I use the language of math (i.e. symbols, words) to make sense of/solve a problem? • How does the math I am learning in the classroom relate to the real-world? • What does a good problem solver do? • What should I do if I get stuck solving a problem? • How do I effectively communicate about math with others in verbal form? In written form? • How do I explain my thinking to others, in written form? In verbal form? • How do I construct an effective (mathematical) argument? • How reliable are predictions? • Why are patterns important to discover, use, and generalize in math? • How do I create a mathematical model? • How do I decide which is the best mathematical tool to use to solve a problem? • How do I effectively represent quantities and relationships through mathematical notation? • How accurate do I need to be? • When is estimating the best solution to a problem?	*Students will understand that...* • Mathematical skills and understandings are used to solve real-world problems. • Problem solvers examine and critique arguments of others to determine validity. • Mathematical models can be used to interpret and predict the behavior of real world phenomena. • Recognizing the predictable patterns in mathematics allows the creation of functional relationships. • Varieties of mathematical tools are used to analyze and solve problems and explore concepts. • Estimating the answer to a problem helps predict and evaluate the reasonableness of a solution. • Clear and precise notation and mathematical vocabulary enables effective communication and comprehension. • Level of accuracy is determined based on the context/situation. • Using prior knowledge of mathematical ideas can help discover more efficient problem solving

	strategies. • Concrete understandings in math lead to more abstract understanding of math.

Transfer
Students will be able to independently use their learning to... know that there are different mathematical models that can be used to represent real world situations, each with a specific purpose and pattern.

Meaning	
Essential Questions	Understandings
Students will consider... • What does the maximum or minimum represent in a real-world context? • When would technology be useful in comparing functions? • How is a transformed function related to its parent function? • Which key feature(s) will best help interpret a problem? • How can you determine the practical domain of the function as it relates to the numerical relationship it describes? • How many solutions does a system with various types of functions contain?	*Students will understand that...* • Technology can be utilized to help investigate functions. • Various representations of the same function emphasize different characteristics of the quadratic function. • Parent functions can be transformed in several ways. • Transformations of functions can be an effective tool to graph and describe functions efficiently. • Piecewise functions, absolute value functions, and step function graphs can be transformed in the same way that linear, exponential and quadratic are transformed. • Contextual situations can have restricted domains and/ranges. • When two functions are graphed simultaneously, where they meet has meaning/context in an equation.

Acquisition	**Acquisition**
Key Knowledge	Key Skills
Students will know... • Intercepts (1-8)	*Students will be able to....* • Interpret key features of graphs and tables in

• End Behavior (1-8) • Symmetries (1-8) • Minimum (1-8, 9-4 Lab) • Maximum (1-8, 9-4 Lab)) • Systems of linear and quadratic functions (9-3) Lab) • The difference between linear, exponential, and quadratic functions (9-6) • Successive differences (with consecutive changes in the domain, notice the type of change in the range) (9-6) • Effect of 1 parameter change (vertical translations, horizontal translations, reflection over x-axis, vertical stretch) on linear, exponential, quadratic and absolute value functions. • Intervals of increasing and decreasing behaviors (9-7) • Different function formats such as piecewise (including step and absolute value functions) (9-7)	terms of a context (1-8) • Sketch a graph showing key features (1-8) • Write a verbal description of a situation given a graph (1-8) • Sketch a graph given a verbal description (1-8) • Find minimum, maximum, end behavior, symmetries, intercepts, and intervals of increasing and decreasing behaviors (1-8, 9-4 Lab, 9-7) • For more complex situations, use a calculator to graph and analyze various types of functions (9-3 lab) • Solve a simple system, in two variables, that contains one linear and one quadratic equation graphically. (9-3 Lab) • Analyze data to determine if the change in domain and range is linear, exponential, or quadratic (9-6) • Write equations of linear, exponential, and quadratic functions based on successive differences (9-6) • Given the equation of a linear, exponential, quadratic, and absolute value function, describe the effect of a single transformation. • Use technology to discover the effects of parameter changes. • Graph various types of functions, including piecewise and absolute value (9-7)

Standards Alignment

F.IF.4
For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★

F.IF.6
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★

F.IF.7
Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
a. Graph quadratic functions and show intercepts, maxima, and minima.
b. Graph piecewise-defined functions, including step functions and absolute value functions.

F.IF.9
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for*

another, say which has the larger maximum.

F.LE.1
Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.LE.5
Interpret the parameters in a linear or exponential functions in terms of a context.

F.BF.3
Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

SHOW-ME STANDARDS

Goals:
1.1, 1.4, 1.5, 1.6, 1.7, 1.8
2.2, 2.3, 2.7
3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
4.1, 4.4, 4.5, 4.6

Performance:
Math 1, 4, 5