Madison County Schools
Suggested Algebra I Pacing Guide, 2016 – 2017

The following Standards have changes from the 2015-16 MS College- and Career-Readiness Standards:

Significant Changes (ex: change in expectations, new Standards, or removed Standards)

A-REI.4b	F-IF.7b
A-REI.5	F-BF.1a
A-REI.11	F-LE.3
F-IF.3	S-ID.1

Slight Changes (slight change or clarification in wording)

N-Q.2
A-APR.3
A-CED.2

Throughout the 2016 Mississippi College- and Career-Readiness Standards for Mathematics Grades K-5 Standards, the words fluency and fluently will appear in bold, italicized, and underlined font (for example: ***fluently***). With respect to student performance and effective in-class instruction, the expectations for mathematical fluency are explained below:

Fluency is not meant to come at the expense of understanding, but is an outcome of a progression of learning and sufficient thoughtful practice. It is important to provide the conceptual building blocks that develop understanding in tandem with skill along the way to fluency; the roots of this conceptual understanding often extend to one or more grades earlier in the standards than the grade when fluency is finally expected.

Wherever the word ***fluently*** appears in a MS CCR content standard, the word means quickly and accurately. It is important to understand that this is not explicitly tied to assessment purposes, but means more or less the same as when someone is said to be fluent in a foreign language. To be fluent is to flow: Fluent isn't halting, stumbling, or reversing oneself.

A key aspect of fluency is this sense that it is not something that happens all at once in a single grade but requires attention to student understanding along the way. It is important to ensure that sufficient practice and extra support are provided at each grade to allow all students to meet the standards that call explicitly for fluency.

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Domain	Abbreviation
The Real Number System	N-RN
Quantities	N-Q [M]
Seeing Structure in Expressions	A-SSE
Arithmetic with Polynomials and Rational Expressions	A-APR
Creating Equations	A-CED [M]
Reasoning with Equations and Inequalities	A-REI
Interpreting Functions	F-IF
Building Functions	F-BF
Linear, Quadratic, and Exponential Models	F-LE [M]
Interpreting Categorical and Quantitative Data	S-ID [M]

[M] Refers to Modeling – Standards with this notation should incorporate real-world contexts and multiple representations (ex: tables, graphs, equations); students are expected to create, compare, and interpret equations, graphs, and functions.

(Shaded Standard) indicates a Standard has been introduced earlier in Algebra I in a different context.

1st 9 Weeks	
N-RN.3	Explain why: • the sum or product of two rational numbers is rational; • the sum of a rational number and an irrational number is irrational; and • the product of a nonzero rational number and an irrational number is irrational.
A-SSE.1a [M]	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients.
A-CED.1 [M]	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-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-REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

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A-CED.3 [M] **(equations & inequalities)**	**Represent constraints by equations or inequalities**, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. (*Note: Systems of equations and/or inequalities will be addressed in 2nd 9 weeks.*)
N-Q.2 [M]	Define appropriate quantities for the purpose of descriptive modeling. [Refer to Quantities section of High School Number and Quantity Conceptual Category.]
A-CED.4 [M]	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.
F-IF.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).
F-LE.1a, b (linear)	Distinguish between situations that can be modeled with **linear functions** and with exponential [or non-linear] 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.
A-CED.2 [M] **(linear)**	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [Note this standard appears in future courses with a slight variation in the standard language.]
A-REI.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
F-IF.5 [M]	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.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

2nd 9 Weeks	
F-IF.7a M (linear)	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 functions (**linear** and quadratic) and show intercepts, maxima, and minima.
N-Q.1 M	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.
F-IF.4 M	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-LE.5 M (linear)	Interpret the parameters in a **linear** or exponential function in terms of a context.
F-BF.3 (linear)	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-LE.2 M (linear and arithmetic)	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-IF.3	Recognize that [linear] sequences are functions whose domain is a subset of the integers. [Removed from 2016-17 Standards for F-IF.3: recursive functions.]
F-BF.1 M	Write a function that describes a relationship between two quantities. a. Determine an explicit expression or steps for calculation from a context. [Removed from 2016-17 Standards for F-IF.3: recursive functions.]
N-Q.2 M	Define appropriate quantities for the purpose of descriptive modeling. [Refer to the Quantities section of High School Number and Quantity Conceptual Category.]
F-IF.9 (linear)	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.11 M (linear)	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**, quadratic, absolute value, and exponential functions. [Removed from 2016-17 Standards for A-REI.11: polynomial, rational, and logarithmic.]

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A-REI.5	Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system.
A-REI.6	Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.
A-CED.2 M (systems)	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [Note this standard appears in future courses with a slight variation in the standard language.]
A-CED.3 M (systems)	**Represent constraints** by equations or inequalities, and **by systems of equations and/or inequalities**, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
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.

3rd 9 Weeks	
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.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$ thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
A-SSE.3a [M]	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 zeros of the function it defines.
A-APR.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nd-degree polynomials).
F-IF.7a. [M] **(quadratic)**	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 functions (linear and **quadratic**) and show intercepts, maxima, and minima.
N-Q.1 [M]	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.
F-IF.4 [M] **(quadratic)**	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-BF.3 (quadratic)	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.
A-CED.2 [M] **(quadratic)**	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [Note this standard appears in future courses with a slight variation in the standard language.]
F-IF.6 (quadratic)	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.9 (quadratic)	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.

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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. [Removed from 2016-17 Standards for A-REI.4: writing complex solutions as $a \pm bi$.]
A-SSE.3b **M**	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
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 factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
A-REI.11 **M** **(linear and quadratic)**	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**, **quadratic**, absolute value, and exponential functions. [Removed from 2016-17 Standards for A-REI.11: polynomial, rational, and logarithmic.]
A-CED.1 **M** **(quadratic)**	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.

4th 9 Weeks	
A-SSE.3c	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%*
A-CED.1 M (exponential)	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-SSE.1b	Interpret expressions that represent a quantity in terms of its context. 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-CED.2 M (exponential)	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. [Note this standard appears in future courses with a slight variation in the standard language.]
F-IF.4 M (exponential)	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-LE.1a, c (exponential)	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.** **c.** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
F-IF.6 (exponential)	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.
N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
F-BF.3 (exponential)	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.9 (exponential)	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.11 M (exponential)	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, quadratic, absolute value, & **exponential functions**. [Removed from 2016-17 Standards for A-REI.11: polynomial, rational, and logarithmic.]

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F-LE.2 [M] **(exponential & geometric)**	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-IF.3	Recognize that [geometric] sequences are functions whose domain is a subset of the integers. [Removed from 2016-17 Standards for F-IF.3: recursive functions.]
F-IF.7b [M]	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 and piecewise-defined functions, including absolute value functions. [Removed from 2016-17 Standards for F-IF.7b: cubic root functions and step functions.]
A-CED.2 [M] **(square root, piecewise)**	Create equations in two variables to represent relationships between graphs; graph equations on coordinate axes with labels and scales. [*Note this standard appears in future courses with a slight variation in the standard language.*]
F-IF.4 [M] **(square root, piecewise)**	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.
S-ID.1 [M]	Represent and analyze data with plots on the real number line (dot plots, histograms, and box plots).
S-ID.2 [M]	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 [M]	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 [M]	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, & conditional relative frequencies). Recognize possible associations & trends in the data.
S-ID.6 [M]	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, quadratic, 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.
S-ID.7 [M]	Interpret the slope (rate of change) and the intercept (constant term) of a linear model.
S-ID.8 [M]	Compute (using technology) and interpret the correlation coefficient of a linear fit.
S-ID.9 [M]	Distinguish between correlation and causation.