How to Read the Crosswalk Document

This West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the Next Generation (NxG) WV Content Standards and Objectives for Mathematics, which have been aligned with the *Common Core State Standards for Mathematics,* and the current 21st Century Content Standards and Objectives (CSOs) for Mathematics in WV Schools.

Grade Change (△) Next Generation WV Objective – WV 21st Century Objective.

Positive (+) Grade Change – Content moving to higher grade.

Negative (-) Grade Change – Content moving to lower grade

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade△	Alignment	
	This objective is the currently adopted objective in WV Public Schools.	**+1 Positive Grade change; Content moving to the next higher grade** **0 No change** **-1 Negative Grade change; Content moving to previous or lower grade**	**Index** **3: Excellent** **2: Partial** **1: Weak** **0: No Match**	**The comment section will provide the reader with specific information relevant to the crosswalk between the standards identified. The intent is to provide the reader specific information relevant to any changes in student expectations.**

High School Mathematics--Math 3

How to Read the Crosswalk Document

The West Virginia Crosswalk document is designed to help readers easily understand the similarities and differences between the 21st Century Content Standards and Objectives for English Language Arts and Mathematics in WV Schools and the Next Generation WV Content Standards and Objectives for English Language Arts and Mathematics that have been aligned with the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects* and the *Common Core State Standards for Mathematics.*

NxG WV State Objective Aligned to CCSS	WV 21st Century Objective	Grade △	Alignment	Comment
M.3HS.IC.1 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *(While students may have heard of the normal distribution, it is unlikely that they will have prior experience*	**M.O.8.5.5** draw inferences, make conjectures and construct convincing arguments involving • different effects that changes in data values have on measures of central tendency • misuses of statistical or numeric information, based on data analysis of same and different sets of data.	+3	3	The NxG WV objective incorporates technology as a tool.
	M.O.A1.2.19 gather **data to create** histograms, box plots, scatter plots and **normal distribution curves and use them to draw and support conclusions about the**	+2	2	The NxG WV objective incorporates technology as a tool and emphasizes that there are data sets for which such a procedure is not appropriate.

using it to make specific estimates. Build on students' understanding of data distributions to help them see how the normal distribution uses area to make estimates of frequencies (which can be expressed as probabilities). Emphasize that only some data are well described by a normal distribution.)	**data**.			
M.3HS.IC.2 Understand that statistics allows inferences to be made about population parameters based on a random sample from that population.	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and **implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that a random sample is a legitimate representation of a larger population.
M.3HS.IC.3 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question*	**M.O.A1.2.20** design experiments to model and solve problems using the concepts of sample space and probability distribution.	+2	3	The NxG WV objective leaves the analysis process open-ended.
	M.O.PC.5.1 identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer;	-1	3	The NxG WV objective leaves the analysis process open-ended.

the model? (Include comparing theoretical and empirical results to evaluate the effectiveness of a treatment.)	develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).			
M.3HS.IC.4 Recognize the purposes of and differences among **sample surveys, experiments, and observational studies**; explain how randomization relates to each. (*Ways of collecting data and use graphical displays and summary statistics to make comparisons. These ideas are revisited with a focus on how the way in which data is collected determines the scope and nature of the conclusions that can be drawn from that data. The concept of statistical significance is developed informally through simulation as meaning a result that is unlikely to have occurred solely as a result of random selection in sampling or random assignment in an experiment.*	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and **implement a method to collect, organize, and analyze related data**; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that sample surveys, experiments, and observational studies may produce representations, but not necessarily exact models of populations.
M.3HS.IC.5 Use data from a	**M.O.A1.2.20** design experiments to	+2	1	The NxG WV objective recognizes that the

sample survey to estimate a population mean or proportion; develop a margin of error through the **use of simulation models for random sampling**.*(Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness).*	model and solve problems using the **concepts of sample space and probability** distribution.			population estimated from a sample survey may not be valid.
	M.O.PC.5.1 identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; **make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	1	The NxG WV objective recognizes that the population estimated from a sample survey may not be valid.
M.3HS.IC.6 Use data from a randomized experiment to compare two treatments; **use simulations to decide if differences between parameters are significant**. *(Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness).*	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; **make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data;** extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without	-1	1	The NxG WV objective recognizes that the population estimated from a randomized experiment may not be valid.

	technology).			
M.3HS.IC.7 Evaluate reports based on data.	**M.O.PC.5.1** identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).	-1	3	The NxG WV objective leaves the analysis process open-ended.
M.3HS.IC.8 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).			0	
M.3HS.IC.9 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *(Extend to more complex probability models. Include situations such as those involving quality control or diagnostic tests that yields both false positive and false negative results.*	**M.O.A1.2.20** design experiments to model and solve problems using the concepts of sample space and probability distribution.	+2	3	The NxG WV objective emphasizes the importance of the analysis process.
M.3HS.PR.1 (+) Extend polynomial identities to the complex numbers. *For example, rewrite x2 + 4 as (x +*	**M.O.A2.2.5** solve quadratic equations over the set of complex numbers: apply the techniques of factoring, completing the square,	0	3	The NxG WV objective extends beyond quadratics.

2i) (x – 2i). (Build on work with quadratics equations in Mathematics II. Limit to polynomials with real coefficients.)	and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze solutions to practical problems.			
M.3HS.PR.2 (+) **Know the Fundamental Theorem of Algebra**; show that it is true for quadratic polynomials.	**M.O.PC.2.2 solve higher order polynomial equations** utilizing techniques such as Descartes" Rule of Signs, upper and lower bounds, and the Rational Root Theorem.	-1	1	The NxG WV objective emphasizes the importance of using FTA in determining the number of factors in polynomial expressions.
M.3HS.PR.3 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.*			0	
M.3HS.PR.4 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 $(x^2 – y^2) (x^2 + y^2)$. *(Extend to polynomial and rational expressions.)*	**M.O.A2.2.5** solve quadratic equations over the set of complex numbers: **apply the techniques of factoring**, completing the square, and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze	0	1	The NxG WV objective expands quadratics to high order polynomials.

	solutions to practical problems.			
M.3HS.PR.5 Derive the formula for the sum of a geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.* ★ *(Consider extending to infinite geometric series in curricular implementations of this course description.)*	**M.O.PC.2.6** solve problems involving the sum of finite and infinite sequences and series, including Sigma notation.	-1	3	The NxG WV objective emphasizes the derivation of the formula.
M.3HS.PR.6 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. *(Extend beyond the quadratic polynomials found in Mathematics II.)*	**M.O.8.2.3** add and subtract polynomials limited to two variables and positive exponents.	+3	3	The NxG WV objective emphasizes the comparisons of different fields in mathematics.
	M.O.A1.2.10 simplify and evaluate algebraic expressions • add and subtract polynomials • multiply and divide binomials by binomials or monomials.	+2	3	The NxG WV objective emphasizes the comparisons of different fields in mathematics.
M.3HS.PR.7 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.			0	
M.3HS.PR.8 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**.	**M.O.PC.2.1** investigate and sketch the graphs of polynomials and rational functions by analyzing and **using the characteristics of zeros**, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	2	The NxG WV objective stresses the importance of finding zeroes when graphing polynomial functions.
	M.O.PC.2.2 solve higher order polynomial equations utilizing	-1	1	The NxG WV objective stresses the importance of finding zeroes when graphing

	techniques such as Descartes" Rule of Signs, upper and lower bounds, and the Rational Root Theorem.			polynomial functions.
M.3HS.PR.9 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.(This cluster has many possibilities for optional enrichment, such as relating the example to the solution of the system* $u^2+v^2=1$, $v = t(u+1)$, *relating the Pascal triangle property of binomial coefficients to* $(x+y)^{n+1} = (x+y)(x+y)^n$, *deriving explicit formulas for the coefficients, or proving the binomial theorem by induction.)*			0	
M.3HS.PR.10 (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle.	**M.O.PC.2.3** relate Pascal's Triangle and the Binomial Theorem; use both to expand binomials with positive integral exponents.	-1	3	There is a strong correlation.
M.3HS.PR.11 Rewrite simple rational expressions in different forms; write *a(x)/b(x)* in the form *q(x) + r(x)/b(x),* where *a(x), b(x), q(x),* and *r(x)* are polynomials with the degree of *r(x)* less than the degree of *b(x),* using inspection, long division, or, for	**M.O.A1.2.16** simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.	+2	3	The NxG WV objective compares polynomial long division to concepts from arithmetic long division.

the more complicated examples, a computer algebra system.*(The limitations on rational functions apply to the rational expressions.)*				
M.3HS.PR.12 (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. *(Requires the general division algorithm for polynomials).*	**M.O.A1.2.16** simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.	+2	3	The NxG WV objective compares rational expressions to properties of rational numbers.
M.3HS.PR.13 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.*(Extend to simple rational and radical equations)*			0	
M.3HS.PR.14 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.★ *(Include combinations of*	**M.O.A1.2.9** create and **solve systems of linear equations graphically and numerically using** the elimination method and the **substitution method**, given a real-world situation.	+2	2	The NxG WV objective expands to higher order polynomial equations.

linear, polynomial, rational, radical, absolute value, and exponential functions.)				
M.3HS.PR.15 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.*(Relate to the relationship between zeros of quadratic functions and their factored forms.)*	**M.O.PC.2.1** investigate and sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.TF.1 Derive the formula *A* = 1/2 *ab* sin(*C*) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	**M.O.T.3.9** develop and test a hypothesis to find the area of a triangle given the measures of two sides and the included angle or the measures of three sides (Heron''s formula) and use these formulas to find total area of figures constructed of multiple shapes.	-1	3	The NxG WV objective is more specific in the method of derivation.
M.3HS.TF.2 (+) Prove the Laws of Sines and Cosines **and use them to solve problems.** *(With respect to the general case of the Laws of Sines and Cosines, the definitions of sine and cosine must be extended to obtuse angles.)*	**M.O.T.3.8 investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results**.	-1	2	The NxG WV objective expands using the Law of Sines and Cosines to proof.
M.3HS.TF.3 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems,	**M.O.T.3.8** investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results.	-1	3	There is a strong correlation.

resultant forces).				
M.3HS.TF.4 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	**M.O.T.3.2** convert angle measures from degrees to radians (and vice versa) and apply this concept to • create a data set, analyze, and formulate a hypotheses to test and develop formulas for the arc length, area of a sector, and angular velocity and use the formula for application in the real-world. • compare and contrast the concepts of angular velocity and linear velocity and demonstrate by graphical or algebraic means relationship between them and apply to real-world problems.	-1	3	The NxG WV objective stresses the importance of using values from the unit circle.
M.3HS.TF.5 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to **all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle**.	**M.O.T.3.4** justify and **present the solutions of trigonometric equations that include both infinite and finite (over a restricted domain) solutions**.	-1	3	The NxG WV objective stresses the importance of using the values of the unit circle.
M.3HS.TF.6 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★	**M.O.T.3.7** model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.	-1	3	There is a strong correlation.
M.3HS.MM.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*	**M.O.A1.2.2** create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or	+2	3	The NxG WV objective expands to quadratic equations.

functions. (Use all available types of functions to create such equations, including root functions, but constrain to simple cases.)	motion and judge the reasonableness of solutions.			
M.3HS.MM.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*(While functions will often be linear, exponential, or quadratic the types of problems should draw from more complex situations than those addressed in Mathematics I. For example, finding the equation of a line through a given point perpendicular to another line allows one to find the distance from a point to a line.)*	**M.O.A1.2.8** identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; **generalize the results to make a conclusion**; compare the hypothesis and the conclusion; **present** the project numerically, analytically, **graphically** and verbally using the predictive and analytic tools of algebra (with and without technology).	+2	1	The NxG WV objective expands to three or more variables.
	M.O.A2.2.15 identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; **compare the hypothesis** and the conclusion; **present** the project numerically, analytically, **graphically** and	0	2	The NxG WV objective expands to three or more variables.

	verbally using the predictive and analytic tools of algebra (with and without technology).			
M.3HS.MM.3 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.*	**M.O.A2.2.10** solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum or minimum values of a function over the feasible region using linear programming techniques.	0	3	There is a strong correlation.
M.3HS.MM.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. (The example given applies to earlier instances of this standard, not to the current course.)*	**M.O.A1.2.3** evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable.	+2	3	There is a strong correlation.
M.3HS.MM.5 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;*	**M.O.A1.2.7 analyze situations and solve problems by determining the equation of a line given a graph of a line**, two points on the line, the slope and a point, or the slope and y intercept.	+2	1	The NxG WV objective expands to higher order equations.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; compare the equation with attributes of an **associated table and graph to demonstrate an understanding of their**	+2	1	The NxG WV objective expands to higher order equations.

symmetries; end behavior; and periodicity.★ (Emphasize the selection of a model function based on behavior of data and context.)	**interrelationship**.			
	M.O.PC.2.1 investigate and sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.	-1	3	There is a strong correlation.
M.3HS.MM.6 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.★*	**M.O.A2.2.7** define a function and find its zeros; **express the domain** and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	2	The NxG WV objective expands to relate the domain to the quantitative relationship it describes.
M.3HS.MM.7 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**.★	**M.O.A1.2.8 identify a real life situation that involves** a constant **rate of change; pose a question; make a hypothesis as to the answer**; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).	+2	2	The NxG WV objective expands to average rate of change and higher order equations.

M.3HS.MM.8 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 square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. *b.* b. **Graph exponential and logarithmic functions**, **showing intercepts and end behavior**, and **trigonometric functions, showing period, midline and amplitude**. *(Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.)*	**M.O.PC.2.1 investigate and sketch the graphs** of polynomials and rational functions **by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range**.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value, exponential, logarithmic and trigonometric functions.
	M.O.A1.2.15 describe real life situations involving exponential growth and decay equations including **$y=2^x$ and $y=(½)^x$; compare the equation** with attributes of an associated table and **graph to demonstrate an understanding** of their interrelationship.	+2	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value and trigonometric functions.
	M.O.A2.2.8 analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.	0	3	The NxG WV objective expands to trigonometric functions.
	M.O.T.3.7 model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value, exponential, and logarithmic functions.
	M.O.PC.2.4 establish and explain the inverse relationship between exponential and logarithmic functions; **graph related functions** and include their domain and range using interval notation.	-1	1	The NxG WV objective incorporates technology as a tool and expands to square root, cube root, piecewise, step, absolute value and trigonometric functions.
M.3HS.MM.9 Write a function defined by an expression in	**M.O.A2.2.4** simplify expressions involving radicals and fractional	0	1	The NxG WV objective expands to all functions.

different but equivalent forms to reveal and explain different properties of the function.	exponents, **convert between the two forms**, and solve equations containing radicals and exponents.			
	M.O.T.3.3 using various methods, basic identities and graphical representation • **verify trigonometric identities** • prove the sum and difference to two angles, double-angles, and half-angle identities.	-1	1	The NxG WV objective expands to all functions.
M.3HS.MM.10 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.*	**M.O.A1.2.21** use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; describe advantages and disadvantages of the use of each representation.	+2	3	There is a strong correlation.
	M.O.PC.2.11 use multiple representations, such as words, graphs, tables, and equations, to solve practical problems involving logarithmic, exponential, polynomial, rational, and radical functions; **explain how the representations are related** to each other, as well as to the problem.	-1	3	There is a strong correlation.
M.3HS.MM.11 Write a function that describes a relationship between two quantities.* Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	3	There is a strong correlation.

model. (Develop models for more complex or sophisticated situations than in previous courses.)				
M.3HS.MM.12 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. (Use transformations of functions to find more optimum models as students consider increasingly more complex situations. Note the effect of multiple transformations on a single function and the common effect of each transformation across function types. Include functions defined only by graph.)*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and **perform basic operations on functions** including composition of functions.	0	1	The NxG WV objective relates the parameters of functions to values that determine transformations.
	M.O.A2.2.8 analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.	0	3	There is a strong correlation.
	M.O.PC.3.1 graph functions and conic sections using transformations.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.MM.13 Find inverse functions. Solve an equation of the form *f(x) = c* for a simple function *f* that has an inverse and write an expression for the inverse. *For example, f(x) = 2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1(Extend to simple rational, simple radical, and simple exponential functions.)*	**M.O.A2.2.7** define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.	0	3	There is a strong correlation.
	M.O.T.3.5 find the value of the inverse trigonometric functions using special angle trigonometric function values and technology.	-1	1	The NxG WV objective expands to all functions.

	• draw inferences of restricted domain to recognize and produce a graph of the inverse trigonometric functions. • prove conjectures made about the solution of the equations such as x = sin (arcsin y), x = sin (arcos y) being sure to consider restrictions of the domain.			
	M.O.PC.2.4 establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation.	-1	1	The NxG WV objective expands to all functions.
M.3HS.MM.14 For exponential models, express as a logarithm the solution to $a\ b^{ct} = d$ where *a, c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology. *(Consider extending this unit to include the relationship between properties of logarithms and properties of exponents, such as the connection between the properties of exponents and the basic logarithm property that log xy = log x + log y.)*	**M.O.PC.2.4** establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation.	-1	3	The NxG WV objective incorporates technology as a tool.
M.3HS.MM.15 Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	**M.O.G.3.16** derive and justify formulas for area, perimeter, **surface area**, and volume **using nets and apply them to solve real-world problems.**	+1	1	The NxG WV objective expands to identifying three-dimensional objects generated by rotations of two-dimensional objects.
	M.O.A2.2.12 analyze the conic sections; identify and sketch the graphs of a parabola, circle, ellipse,	0	3	There is a strong correlation.

	and hyperbola and convert between graphs and equations.			
M.3HS.MM.16 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★			0	
M.3HS.MM.17 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★			0	
M.3HS.MM.18 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★			0	