PUBLISHER:			
SUBJECT:		**SPECIFIC GRADE:**	
COURSE:		**TITLE**	
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SE ISBN:		**TE ISBN:**	

NON-NEGOTIABLE EVALUATION CRITERIA

2018-2024
Group VI – Mathematics
High School Math III TR & High School Math IV TR

Equity, Accessibility and Format			
Yes	No	CRITERIA	NOTES
		1. INTER-ETHNIC The **instructional** materials meets the requirements of inter-ethnic: concepts, content and illustrations, as set by WV Board of Education Policy 2445.41.	
		2. EQUAL OPPORTUNITY The instructional material meets the requirements of equal opportunity: concepts, content, illustration, heritage, roles contributions, experiences and achievements of males and females in American and other cultures.	
		3. FORMAT This resource includes an interactive electronic/digital component for students.	
		4. BIAS The instructional material is free of political bias.	
		5. **COMMON CORE** The instructional materials do not reference Common Core academic standards. (WV Code §18-2E-1b-1).	

GENERAL EVALUATION CRITERIA
2018-2024
Group VI – Mathematics
High School Math III TR & High School Math IV TR

The general evaluation criteria apply to each grade level and are to be evaluated for each grade level unless otherwise specified. These criteria consist of information critical to the development of all grade levels. In reading the general evaluation criteria and subsequent specific grade level criteria, **e.g. means "examples of" and i.e. means that "each of" those items must be addressed**. Eighty percent of the general and eighty percent of the specific criteria must be met with I (in-depth) or A (adequate) in order to be recommended.

(Vendor/Publisher) SPECIFIC LOCATION OF CONTENT WITHIN PRODUCTS	(IMR Committee) Responses							
	I=In-depth, **A**=Adequate, **M**=Minimal, **N**=Nonexistent	**I**		**A**		**M**		**N**
	In addition to alignment of Content Standards, materials must also clearly connect to Learning for the 21st Century which includes opportunities for students to develop:							
Communication and Reasoning								
For student mastery of College- and Career-Readiness Standards, the instructional materials will include multiple strategies that provide students opportunities to:								
	1. Explain the correspondence between equations, verbal descriptions, tables, and graphs.							
	2. Make conjectures and build a logical progression of statements to explore the truth of their conjectures.							
	3. Distinguish correct logic or reasoning from that which is flawed.							
	4. Justify their conclusions, communicate them to others, and respond to the arguments of others.							
	5. Evaluate the reasonableness of intermediate results.							
	6. Communicate precisely to others using appropriate mathematical language. When more than one term can describe a concept, use vocabulary from the West Virginia College- and Career-Readiness Standards.							

	7. Articulate thoughts and ideas through oral, written, and multimedia communications.								
Mathematical Modeling									
For student mastery of College- and Career-Readiness Standards, the instructional materials will include multiple strategies that provide students opportunities to:									
	8. Apply mathematics to solve problems in everyday life.								
	9. Use concrete objects, pictures, diagrams, or graphs to help conceptualize and solve a problem.								
	10. Use multiple representations.								
	11. Use a variety of appropriate tools strategically.								
	12. Calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.								
	13. Interpret their mathematical results in the context of the situation.								
	14. Reflect on whether the results make sense, improving the model if it has not serve its purpose.								
	15. Explore careers which apply the understanding of mathematics.								
Seeing Structure and Generalizing									
For student mastery of College- and Career-Readiness Standards, the instructional materials will include multiple strategies that provide students opportunities to:									
	16. Look closely to discern a pattern or structure.								
	17. Look both for general methods and for shortcuts.								
	18. Make sense of quantities and their relationships in problem situations.								
	19. Assess and evaluate the type of mathematics needed to solve a particular problem.								

	20. Apply appropriate mathematical skills to unfamiliar complex problems.							
	21. Maintain the oversight of the process of solving a problem while attending to the details.							
Instructor Resources and Tools								
The instructional materials provide:								
	22. An ongoing spiraling approach.							
	23. Ongoing diagnostic, formative, and summative assessments.							
	24. A variety of assessment formats, including performance tasks, data-dependent questions, and open-ended questions.							
	25. Necessary mathematical content knowledge, pedagogy, and management techniques for educators to guide learning experiences.							
	26. Presentation tools for educators to guide learning.							
	27. Multiple research-based strategies for differentiation, intervention, and enrichment to support all learners.							

SPECIFIC EVALUATION CRITERIA

2018-2024
Group VI – Mathematics
High School Math III TR & High School Math IV TR

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Students in this course will make connections and applications the accumulation of learning that they have from their previous courses, with content grouped into four critical units. Students will apply methods from probability and statistics to draw inferences and conclusions from data. They will expand their repertoire of functions to include polynomial, rational and radical functions and their study of right triangle trigonometry to include general triangles. Students will bring together their experiences with functions and geometry to create models and solve contextual problems. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Students will continue developing mathematical proficiency in a developmentally-appropriate progressions of standards. Continuing the skill progressions from previous courses, the following chart represents the mathematical understandings that will be developed:

Inferences and Conclusions from Data	**Polynomials, Rational, and Radical Relationships**
• Make inferences and justify conclusions from sample surveys, experiments, and observational studies. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	• Derive the formula for the sum of a geometric series, and use the formula to solve problems. (e.g., Calculate mortgage payments.)
Trigonometry of General Triangles and Trigonometric Functions	**Mathematical Modeling**
• Apply knowledge of the Law of Sines and the Law of Cosines to determine distances in realistic situations. (e.g., Determine heights of inaccessible objects.)	• Analyze real-world situations using mathematics to understand the situation better and optimize, troubleshoot, or make an informed decision. (e.g., Estimate water and food needs in a disaster area, or use volume formulas and graphs to find an optimal size for an industrial package.)

For student mastery of content standards, the instructional materials will provide students with the opportunity to

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	I=In-depth, **A**=Adequate, **M**=Minimal, **N**=Nonexistent	**I**		**A**		**M**		**N**
Inferences and Conclusions from Data								
Summarize, represent, and interpret data on single count or measurement variable.								
	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. Instructional Note: While students may have heard of the normal distribution, it is unlikely that they will have prior experience 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.								
Understand and evaluate random processes underlying statistical experiments.									
	2. Understand that statistics allows inferences to be made about population parameters based on a random sample from that population.								
	3. Decide if a specified model is consistent with results from a given data-generating process, for example, using simulation. (e.g., 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 the model?) Instructional Note: Include comparing theoretical and empirical results to evaluate the effectiveness of a treatment.								
Make inferences and justify conclusions from sample surveys, experiments, and observational studies.									
	4. Recognize the purposes of and differences among sample surveys, experiments and observational studies; explain how randomization relates to each. Instructional Note: In earlier grades, students are introduced to different 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.								
	5. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. Instructional Note: Focus on the variability of results from experiments—that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness.								
	6. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. Instructional Note: Focus on the variability of results from experiments—								

	that is, focus on statistics as a way of dealing with, not eliminating, inherent randomness.							
	7. Evaluate reports based on data. Instructional Note: In earlier grades, students are introduced to different 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.							
Use probability to evaluate outcomes of decisions.								
	8. Use probabilities to make fair decisions (e.g., drawing by lots or using a random number generator).							
	9. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, and/or pulling a hockey goalie at the end of a game). Instructional Note: 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.							
Polynomials, Rational and Radical Relationships								
Interpret the structure of expressions.								
	10. 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. (e.g., Interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.) Instructional Note: Extend to polynomial and rational expressions.							
	11. 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 $(x^2 – y^2)(x^2 + y^2)$. Instructional Note: Extend to polynomial and rational expressions.							
Write expressions in equivalent forms to solve problems.								

	12. Derive the formula for the sum of a geometric series (when the common ratio is not 1), and use the formula to solve problems. (e.g., Calculate mortgage payments.) Instructional Note: Consider extending to infinite geometric series in curricular implementations of this course description.							
Perform arithmetic operations on polynomials.								
	13. 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. Instructional Note: Extend beyond the quadratic polynomials found in Mathematics II.							
Understand the relationship between zeros and factors of polynomials.								
	14. 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 $p(x)$.							
	15. 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.							
Use polynomial identities to solve problems.								
	16. 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. Instructional Note: This cluster has many possibilities for optional enrichment, such as relating the example in M.A2HS.10 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.							
	17. 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. Instructional Note: This cluster has many possibilities for optional enrichment, such as relating the example in M.A2HS.10 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.							

Rewrite rational expressions.								
	18. 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 the more complicated examples, a computer algebra system. Instructional Note: The limitations on rational functions apply to the rational expressions.							
Understand solving equations as a process of reasoning and explain the reasoning.								
	19. Solve simple rational and radical equations in one variable and give examples showing how extraneous solutions may arise. Instructional Note: Extend to simple rational and radical equations.							
Represent and solve equations and inequalities graphically.								
	20. 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. Instructional Note: Include combinations of linear, polynomial, rational, radical, absolute value, and exponential functions.							
Analyze functions using different representations.								
	21. 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. Instructional Note: Relate to the relationship between zeros of quadratic functions and their factored forms.							
Trigonometry of General Triangles and Trigonometric Functions								
Apply trigonometry to general triangles.								
	22. 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.							

	23. Prove the Laws of Sines and Cosines and use them to solve problems. Instructional Note: 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.							
	24. 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 and/or resultant forces).							
Extend the domain of trigonometric functions using the unit circle.								
	25. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.							
	26. 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.							
Model periodic phenomena with trigonometric functions.								
	27. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.							
Mathematical Modeling								
Create equations that describe numbers or relationships.								
	28. 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. Instructional Note: Use all available types of functions to create such equations, including root functions, but constrain to simple cases.							
	29. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Instructional Note: 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.							

	30. 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. (e.g., Represent inequalities describing nutritional and cost constraints on combinations of different foods.)							
	31. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (e.g., Rearrange Ohm's law $V = IR$ to highlight resistance R.) Instructional Note: The example given applies to earlier instances of this standard, not to the current course.							
Interpret functions that arise in applications in terms of a context.								
	32. 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. Instructional Note: Emphasize the selection of a model function based on behavior of data and context.							
	33. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (e.g., 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.) Instructional Note: Emphasize the selection of a model function based on behavior of data and context.							
	34. 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. Instructional Note: Emphasize the selection of a model function based on behavior of data and context.							
Analyze functions using different representations.								
	35. 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. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period,							

	midline and amplitude. Instructional Note: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.							
	36. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Instructional Note: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.							
	37. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). (e.g., Given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.) Instructional Note: Focus on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.							
Build a function that models a relationship between two quantities.								
	38. Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. (e.g., 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 model.) Instructional Note: Develop models for more complex or sophisticated situations than in previous courses.							
Build new functions from existing functions.								
	39. 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. Instructional Note: 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.							
	40. 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.							

	(e.g., $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.) Instructional Note: Extend this standard to simple rational, simple radical, and simple exponential functions.							
Construct and compare linear, quadratic, and exponential models and solve problems.								
	41. 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. Instructional Note: 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.							
Visualize relationships between two dimensional and three-dimensional objects.								
	42. Identify the shapes of two-dimensional cross-sections of three dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional objects.							
Apply geometric concepts in modeling situations.								
	43. Use geometric shapes, their measures and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).							
	44. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile or BTUs per cubic foot).							
	45. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost and/or working with typographic grid systems based on ratios).							