

# Institutional Report

STANDARDS	PROPOSED CHANGES TO RULES	COMMENTS
Draft 2014		
<b><u>10.58.518 MATHEMATICS</u></b>		
(1) The program requires that successful candidates:	(1) The program requires that successful candidates:	
(a) demonstrate knowledge and understanding of and apply the process of mathematical problem solving;	(a) demonstrate knowledge and understanding of and apply the process of mathematical problem solving;	
(b) reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry;	<del>(b) reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry;</del> <u>(b) reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry;</u>	
	<u>(c) demonstrate an appreciation for mathematical rigor and inquiry;</u>	
(c) communicate mathematical thinking orally and in writing to peers, faculty, and others;	<del>(c) communicate mathematical thinking orally and in writing to peers, faculty, and others;</del> <u>(d) recognize, formulate, and apply connections between mathematical ideas and representations in a wide variety of contexts;</u>	
	<u>(e) demonstrate understanding of the mathematical modeling process by interpreting and analyzing mathematical results and models in terms of their reasonableness and usefulness;</u>	
(d) recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding;	<del>(d) recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding;</del> <u>(f) recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding including ability to</u>	
	(i) attend to precision in mathematical language, notation, approximations and measurements by consistently and appropriately applying mathematical definitions and procedures; and	



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	(ii) choose appropriate symbolic representations and labels such as specifying units of measure, calculating accurately and efficiently, and expressing numerical answers with a degree of precision appropriate for the context and the data used in calculation;	
(e) use varied representations of mathematical ideas to support and deepen students' mathematical understanding;	<del>(e) use varied representations of mathematical ideas to support and deepen students' mathematical understanding;</del>	
(f) appropriately use current and emerging technologies as essential tools for teaching and learning mathematics; and	<del>(f)</del> (g) appropriately use current and emerging technologies as essential tools for teaching and learning mathematics; and	
(g) support a positive disposition toward mathematical processes and mathematical learning;	<del>(g) support a positive disposition toward mathematical processes and mathematical learning;</del> <u>(h) look for and recognize repeated reasoning patterns and the mathematical structures behind those patterns to organize and generalize mathematical methods and results in mathematical problem solving and inquiry;</u>	
(2) demonstrate knowledge of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning;	(2) <u>The program requires that successful candidates demonstrate knowledge of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning by:</u>	
	<u>(a) demonstrating how learners develop mathematical proficiency through the interdependent processes of integrating conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition;</u>	
	<u>(b) demonstrating an understanding of individual differences and diverse cultures and communities to</u>	



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	<u>ensure inclusive learning environments in mathematics and ensure high standards of mathematical work for all students;</u>	
	<u>(c) demonstrating an understanding of learning environments that promote mathematical learning, including individual and collaborative learning, positive social interaction about mathematics, active engagement in mathematics learning, and promote self-motivation among mathematical learners;</u>	
	<u>(d) demonstrating an understanding of multiple methods of assessment of mathematical learner growth, progress, and decision making;</u>	
	<u>(e) demonstrating an understanding of a variety of instructional strategies that encourage learners to develop deep understanding of mathematics; and</u>	
	<u>(f) demonstrating an understanding of grades 5-12 mathematics curriculum as specified by the State of Montana Content Standards and of the assessment process as specified by the Montana statewide assessment;</u>	
(3) demonstrate content knowledge in:	(3) demonstrate content knowledge in	
(a) numbers and operations by demonstrating computational proficiency, including a conceptual understanding of numbers, ways of representing number relations among number and number systems, and meanings of operations;	<u>(a) numbers and operations by demonstrating computational proficiency, including a conceptual understanding of numbers, ways of representing number relations among number and number systems, and meanings of operations; knowledge and understanding of number systems, arithmetic algorithms, fundamental</u>	



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	<u>ideas of number theory, proportion and rate, quantitative reasoning, modeling and applications;</u>	
(b) different perspectives on algebra including ways of representing mathematical relationships and algebraic structures;	(b) <del>different perspectives on algebra including ways of representing mathematical relationships and algebraic structures;</del> <u>by demonstrating knowledge and understanding of algebraic structures, basic function classes, functional representations, algebraic models and applications, formal structures and results in abstract algebra and linear algebra;</u>	
(c) geometries by using spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties;	<del>(c) geometries by using spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties;</del> (c) <u>geometry and trigonometry by demonstrating knowledge and understanding of Euclidean and non-Euclidean geometries, geometric transformations, axiomatic reasoning and proof, formulas and calculations related to classical geometric objects, and properties of trigonometric functions;</u>	
(d) calculus by demonstrating a conceptual understanding of limit, continuity, differentiation, and integration and a thorough background in the techniques and application of the calculus;	(d) <del>calculus by demonstrating a conceptual</del> <u>knowledge and understanding of limit, continuity, differentiation, and integration involving single and multiple-variable functions, sequences and series, and a thorough background in the techniques and application of the calculus;</u>	
(e) discrete mathematics by applying the fundamental ideas of discrete mathematics in the formulation and solution of problems;	(e) <del>discrete mathematics by applying the fundamental ideas of discrete mathematics</del> <u>demonstrating knowledge and understanding of basic discrete structures, counting</u>	



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	<u>techniques, iteration, recursion, formal logic, and applications</u> in the formulation and solution of problems;	
(f) data analysis, statistics, and probability by demonstrating an understanding of concepts and practices related to data analysis, statistics, and probability; and	(f) data analysis, statistics, and probability by demonstrating an understanding of <del>concepts and practices related to data analysis, statistics, and probability</del> ; descriptive statistics using numbers and graphs, survey design, sources of bias and variability, empirical and theoretical probability, simulation, and inferential statistics related to univariate and bivariate data distributions; and	
(g) measurement by applying and using measurement concepts and tools.	<del>(g) measurement by applying and using measurement concepts and tools.</del> <u>(g) historical development and perspectives of various branches of mathematics including contributions of significant historical figures and diverse cultures, including American Indians and tribes in Montana.</u>	
(History: 20-2-114, MCA; <u>IMP</u> , 20-2-121, MCA; <u>NEW</u> , 1979 MAR p. 492, Eff. 5/25/79; <u>AMD</u> , 1984 MAR p. 831, Eff. 5/18/84; <u>AMD</u> , 1989 MAR p. 397, Eff. 3/31/89; <u>AMD</u> , 1994 MAR p. 2722, Eff. 10/14/94; <u>AMD</u> , 2000 MAR p. 2406, Eff. 9/8/00; <u>AMD</u> , 2007 MAR p. 190, Eff. 2/9/07.)		

