



2012 Curriculum Guide

Aligned to the Montana Common Core 2012

9-12 Mathematics

Special Editors:
Montana Rural Teachers
Montana County Superintendents
Montana Small Schools Alliance

Mathematics Standard: Algebra (problem solving)

Students engage in the mathematical processes of problem solving and reasoning, estimation, communication, connections and applications, and using appropriate technology.

Rationale:

These processes are essential to all mathematics and must be incorporated in all other mathematics standards.

9	10	11	12
Recognize and apply algebra techniques to problem solving. A-SSE.1.a.b	Recognize and apply geometric principles to problem solving. A-SSE.4	Apply and formulate upper level algebra strategies to problem solving. A-SSE.3.a.b	M: Benchmark 1: Recognize and formulate problems from situations within and outside mathematics and apply solution strategies to those problems. A-SSE.3.a.b.c
Apply 'finding curve of best-fit' strategy to estimate. A-REL.10.11.12	Demonstrate estimation strategies throughout the problem-solving process.	Select and evaluate appropriate estimation strategies throughout the problem-solving process.	M: Benchmark 2: Select, apply, and evaluate appropriate estimation strategies throughout the problem-solving process.
Formulate definitions of algebraic concepts, such as slope, and intercept. Translate problems into equations or inequalities. A-SSE.3.a.b.c.d	M: Use reasoning to formulate and communicate logical arguments. A-SSE.3.a.b.c.d	Formulate definitions of algebraic concepts, such as conic sections. A-SSE.3.a.b.c.d	M: Benchmark 3: Use reasoning to formulate and communicate logical arguments and proofs. A-APR.6.7
Apply procedures including algebraic manipulations, graphing, estimation, lists, etc. across the curriculum.	Use modeling and algebraic techniques to solve real-world geometric problems.	Apply problem-solving strategies to more complex problems in disciplines other than mathematics.	M: Benchmark 4: Apply and translate among different representations of the same problem situation or of the same mathematical concept. Model connections between problem situations that arise in disciplines other than mathematics.
Select and use appropriate technology to solve basic algebraic and geometry problems.	M: Apply mathematical processes and technologies to solve a variety of problems and communicate the results.	Select and use appropriate technology to solve more complex situations.	M: Benchmark 5: Apply mathematical processes and technologies correctly to solve a variety of problems and communicate the results.

Mathematics Standard: Number and Quantity

Students demonstrate understanding of and an ability to use numbers and operations.

Rationale:

An understanding of numbers and how they are used is necessary in the everyday world. Computational skills and procedures should be developed in context so the learner perceives them as tools for solving problems.

9	10	11	12
Define number systems (e.g., real, whole, irrational subsystems). N-RN.1.2.3	Extend understanding of irrational numbers and simplifying radical expressions. N-RN.1.2.3	Apply simplification of irrational numbers to higher indexed radicals and introduce transcendental radicals. N-RN.4.5.6	M: Benchmark 1: Use and understand the real number system, its operations, notations, and the various subsystems. N-RN.1.2.3
Recognize the square root of negative numbers as being complex numbers. N-RN.1	Recognize the square root of negative numbers as being complex numbers. N-RN.1	Provide an advanced definition for complex numbers. N-CN.1.2.3	M: Benchmark 2: Use definitions and basic operations of the complex number system. N-CN.1.2.3
	M: Use real and complex number systems to solve mathematical problems. N-CN.7.8.9	Use complex numbers in polynomials.	M: Use real and complex number systems to solve mathematical problems. N-CN.7.8.9

Mathematics Standard: Algebra (processing)

Students use algebraic concepts, processes, and language to model and solve a variety of real-world and mathematical problems.

Rationale:

Algebra is the language of mathematics and science. Through the use of variables and operations, algebra allows students to form abstract models from contextual information.

9	10	11	12
Discover and generalize patterns of change.	Create and apply generalized patterns of change.	Create patterns of change at a more advanced level.	M: Benchmark 1: Use algebra to represent patterns of change.
Practice and use basic operations (addition, subtraction, multiplication, division, powers) with algebraic expressions. A-APR.1	M: Apply functions, graphs, and algebraic concepts to solve real-world problems including operations in geometric problems, such as placing geometric figures on the coordinate plane and labeling appropriately. A-REL.1.2	Apply functions, graphs and with algebraic concepts to solve real world problems.	M: Benchmark 2: Apply functions, graphs, and algebraic concepts to solve real and theoretical problems.
Solve linear and quadratic equations and inequalities using graphing and algebraic techniques. A-CED.1.2,3,4	Apply geometric principles to solve algebraic equations (e.g., linear, quadratic, exponential). A-REL.3.4 a,b	Solve exponential, logarithmic and power equations and inequalities using graphing and algebraic techniques. A-REL.3.4 a,b	M: Benchmark 3: Solve algebraic equations and inequalities: linear, quadratic, exponential, logarithmic, and power. A-REL.3.4 a,b
Solve systems of algebraic equations and inequalities with two variables using graphing, substitution and elimination (linear combination). A-REL.10.11.12	Apply algebraic techniques to solving systems of equations. A-REL.10.11.12	Solve systems of algebraic equations and inequalities using two or more variables including matrices. A-REL.10.11.12	M: Benchmark 4: Solve systems of algebraic equations and inequalities, including use of matrices. A-REL.10.11.12
Formulate linear and quadratic models to solve mathematical and real-world problems.	Apply use of linear and quadratic models to solve mathematical and real-world problems.	Use exponential, logarithmic and power models to solve mathematical and real-world problems.	M: Benchmark 5: Use algebraic models to solve mathematical and real-world problems.
Interpret the structure of expressions. Use the structure of expressions to rewrite and use equivalent forms to solve problems.			

Mathematics Standard: Geometry

Students demonstrate understanding of shape and an ability to use geometry.

Rationale:

The study of geometry helps students represent and make sense of the world by discovering relationships and developing spatial sense.

9	10	11	12
Construct, interpret and draw three-dimensional objects using computer programs or isometric dot paper. <u>G-CO.12.13</u>	M: Apply geometric relationships and properties to model a variety of problems and situations. <u>G-CO.1.2.3.4.5</u>	Construct, interpret, and draw three-dimensional objects. <u>G-CO.12.13</u>	M: Benchmark 1: Apply geometric and algebraic relationships to model a variety of problems and situations. <u>G-CO.1.2.4.7.10</u>
Apply direct variation to similar figures. <u>G-CO.6.7.8</u>	Classify figures in terms of congruence and similarity. <u>G-CO.1.2.3.4.5</u>	Classify figures in terms of congruence and similarity and apply these relationships. <u>G-CO.1.2.3.4.5</u>	M: Benchmark 2: Classify figures in terms of congruence and similarity and apply these relationships. <u>G-CO.1.2.3.4.5</u>
Identify coordinate representatives. <u>GMD.1.2.3.4</u>	Identify synthetic representatives. <u>GMD.1.2.3.4</u>	Compare synthetic and coordinate representatives. <u>GMD.1.2.3.4</u>	M: Benchmark 3: Translate between synthetic and coordinate representatives. <u>GMD.1.2.3.4</u>
Use distance, slope and midpoint formulas in problem solving. Draw vectors and measure resultant vectors. <u>G-SRT.6.7.8</u>	Deduce properties of figures using transformation and coordinates in problem solving. <u>G-SRT.6.7.8</u>	Solve basic vector problems using trigonometry. <u>G-SRT.6.7.8</u>	M: Benchmark 4: Deduce properties of figures using transformations, coordinates, and vectors in problem solving. <u>G-SRT.6.7.8</u>
Apply basic trigonometric ratios to problem solving situations involving right triangles. <u>G-SRT.6.7.8</u>	Identify law of sines, law of cosines, and basic trigonometric ratios in problem solving involving different kinds of triangles. <u>G-SRT.6.7.8</u>	Apply trigonometric ratios to problem situations involving triangles. <u>G-SRT.6.7.8</u>	M: Benchmark 5: Apply trigonometric ratios (sine, cosine, and tangent) to problem situations involving triangles. <u>G-SRT.6.7.8</u>
Prove geometric theorems about lines, angles, triangles, parallelograms..	Make geometric constructions with a variety of tools and methods (compass, straightedge, string, reflective devices, paper folding, software, etc)		

Mathematics Standard: Modeling

Students demonstrate understanding of measurable attributes and an ability to use measurement processes.

Rationale:

The first step in scientific investigation is in understanding the measurable attributes of objects.

9	10	11	12
Apply scale factors, rates of change and distance formula to linear indirect measurement.	Apply scale factors to two and three- dimensional indirect measurement.	Apply concepts of indirect measurement to conic sections.	M: Benchmark 1: Apply concepts of indirect measurements (e.g., using similar triangles to calculate a distance).
Explore dimensional analysis to insure appropriate labels on solutions.	M: Apply complex measurement to describe objects in the physical world and solve real-world problems	Use dimensional analysis to check reasonableness of procedures.	M: Benchmark 2: Apply complex measurement and appropriately analyze error of measurement, precision and accuracy.
Observe dimensional analysis to investigate systems of derived measures, such as density and speed.	M: Compare and contrast objects in the physical world.	Compare systems of deprived measures.	M: Benchmark 3: Investigate systems of derived measures (e.g., km/sec, g/cm³).
Use scientific notation to apply appropriate concepts of estimates in measurement, error in measurement (accuracy), and precision.	Use scientific notation to apply appropriate concepts of estimates in measurement, error in measurement (accuracy), and precision.	Use scientific notation to apply appropriate concepts of tolerance.	M: Benchmark 4: Apply the appropriate concepts of estimates in measurement, error in measurement, tolerance, and precision.

Mathematics Standard: Statistics and Probability

The students demonstrate understanding of and an ability to use data analysis, probability, and statistics.

Rationale:

With society's expanding use of data for prediction and decision making, it is important that students develop an understanding of the concepts and processes used in analyzing data.

9	10	11	12
Collect, organize, describe, and determine appropriate curve fitting equation for linear, quadratic, and exponential data and make predictions from the data. <u>S-ID.1.2.3.4</u>	Collect, organize, describe, and determine appropriate curve fitting equation for linear, quadratic, and exponential data and make predictions from the data. <u>S-ID.1.2.3.4</u>	Collect, organize, describe, and determine appropriate curve fitting equation for logarithmic and power data and make predictions from the data. <u>S-ID.1.2.3.4</u>	M: Benchmark 1: Use curve fitting to make predictions from data. <u>S-ID.5.6.7.8.9</u>
Identify measures of central tendency. <u>S-IC.1.2.3.4.5.6</u>	Demonstrate understanding of effects of outliers on measures of central tendency. <u>S-IC.1.2.3.4.5.6</u>	Calculate correlation. <u>S-IC.1.2.3.4.5.6</u>	M: Benchmark 2: Apply measures of central tendency and demonstrate understanding of the concepts of variability and correlation. <u>S-IC.1.2.3.4.5.6</u>
Identify and justify a sampling method that has that appropriate sample size, is free of bias, and has been randomly collected. <u>S-CP.2.3</u>	M: Make reasonable predictions and decisions based on data, probability, and statistics. <u>S-IC.3.4.5.6</u>	Select an appropriate sampling method for a given statistical analysis. <u>S-MD.3.4</u>	M: Benchmark 3: Design simple statistical experiments selecting appropriate samples and make reasonable predictions and decisions based on data, probability, and statistics. <u>S-MD.5.6.7</u>
Understand that simulation methods represent and solve problems. <u>S-IC.1.2</u>	Understand experimental and theoretic probability. <u>S-IC.1.2</u>	Apply experimental probability, theoretical probability, and simulation methods to represent and solve problems, including expected values. <u>S-CP.6.7.8.9</u>	M: Benchmark 4: Use experimental probability, theoretical probability, and simulation methods to represent and solve problems, including expected values. <u>S-CP.6.7.8.9</u>
Understand how graphs communicate the results of a statistical experiment. <u>S-MD.5.6.7</u>	Create graphs from a statistical experiment. <u>S-MD.5.6.7</u>	Design a statistical experiment and communicate the results using graphs (with and without calculators), analyses, etc. <u>S-MD.5.6.7</u>	M: Benchmark 5: Design a statistical experiment to study a problem and communicate the outcomes. <u>S-MD.5.6.7</u>
Recognize data that does or does not fit a normal curve. <u>S-CP.4.5</u>	Describe in general terms the normal curve. <u>S-CP.4.5</u>	Apply mean and standard deviation concepts to a normal curve. <u>S-CP.4.5</u>	M: Benchmark 6: Describe, in general terms, the normal curve and use its properties to answer questions about sets of data that are assumed to be normally distributed. <u>S-CP.4.5</u>

Mathematics Standard: Functions

Students demonstrate understanding of and an ability to use patterns, relations, and functions.

Rationale:

One of the central themes of mathematics is the study of patterns, relations, and functions. Exploring patterns helps students develop mathematical power and instills in them an appreciation for the beauty of mathematics.

9	10	11	12
Describe linear and quadratic functions and their inverses using graphical, numerical, physical, algebraic, and verbal mathematical models or representations. F-IE.1.2.3	Describe geometrical functions using graphs and physical models and M: Analyze functions using graphical, numerical and algebraic methods. F-IE.7.a,b,c,d,e	Describe logarithmic, power and exponential functions and their inverses using graphical, numerical, physical, algebraic, and verbal mathematical models or representations. F-IE.7.a,b,c,d,e	M: Benchmark 1: Analyze functions using graphical, numerical, and algebraic methods and select the appropriate function to model real-world phenomena. F-IE.7.a,b,c,d,e
Analyze the graphs of linear and quadratic families. F-IE.7.8.9	Analyze the graphs of polynomial functions. F-IE.7.8.9	Analyze the graphs of rational, power, exponential and logarithmic families. F-IE.7.8.9	M: Benchmark 2: Analyze the graphs of the families of polynomial, rational, power, exponential, logarithmic, and periodic functions. F-IE.7.8.9
Analyze the effects of parameter changes on linear and quadratic functions and relations. F-IE.7.8.9	Analyze the effects of parameter changes on polynomial and rational relations. F-IE.7.8.9	Analyze the effects of parameter changes on conic relations, power, exponential, and logarithmic functions. F-IE.7.8.9	M: Benchmark 3: Analyze the effects of parameter changes on the graphs of functions and relations, including translations. F-IE.7.8.9
Model real-world phenomena with linear and quadratic functions. F-BE.1.2.3.4	Model real-world geometric phenomena with variety of functions. F-BE.1.2.3.4	Model real-world phenomena with polynomial, rational, power, exponential and logarithmic functions and conic relations. F-BE.1.2.3.4	M: Benchmark 4: Model real-world phenomena with a variety of functions. F-BE.1.2.3.4
Identify parametric and three-dimensional equations. F-IE.1.2.3.4	Explain recursive relations. F-IE.5	Use graphing for parametric equation, three-dimensional equations, and recursive relations. F-TE.1.2.3.4	M: Benchmark 5: Use graphing for parametric equations, three-dimensional equations, and recursive relations. F-TE.5.6.7