

The North Dakota Standards and Benchmarks

Content Standards – DRAFT

Mathematics Grade 9-10 – Content Only

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North Dakota Department of Public Instruction

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Standard 1: Number and Operation

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

Grades 9-10

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 9-10.1.1. Express numbers between one-billionth and one billion in fraction, decimal, and verbal form; express numbers of all magnitudes in scientific notation
- 9-10.1.2. Describe the hierarchal relationships (e.g., integers are rationals) among subsets of the real number system; i.e., reals, rationals, irrationals, integers, wholes, and naturals
- 9-10.1.3. Identify the properties of the real number system; i.e., commutative, associative, distributive, closure, inverse, and identity properties
- 9-10.1.4. Represent a set of data in a matrix

OPERATIONS AND THEIR PROPERTIES

- 9-10.1.5. Use the order of operations to simplify an algebraic expression
- 9-10.1.6. Analyze the effects of multiplication, division, raising to a power, and extracting a root on the magnitudes of quantities; e.g., when will the square root of a number be greater than the number itself, or what will happen to the magnitude of a number when you multiply it by a negative number?
- 9-10.1.7. Apply basic properties of exponents to simplify algebraic expressions; i.e., power of a product, power of a power, products and quotients of powers, zero and negative exponents

COMPUTATIONAL FLUENCY AND ESTIMATION

- 9-10.1.8. Apply estimation skills to predict realistic solutions to problems
- 9-10.1.9. Select and use an appropriate computational technique (i.e., mental calculation, paper-and-pencil, or technology) to solve problems involving real numbers
- 9-10.1.10. Explain the reasonableness of a problem's solution and the process used to obtain it
- 9-10.1.11. Add, subtract, and perform scalar multiplication on matrices

Standard 2: Geometry and Spatial Sense

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

Grades 9-10

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 9-10.2.1. Identify the properties and attributes of two- and three-dimensional objects that distinguish one from another; e.g., a cylinder has two parallel circular bases
- 9-10.2.2. Determine congruence and similarity among geometric objects
- 9-10.2.3. Use trigonometric relationships and the Pythagorean Theorem to determine side lengths and angle measures in right triangles
- 9-10.2.4. Using given information, establish the validity of a conjecture using a two-column or paragraph proof

COORDINATE GEOMETRY

- 9-10.2.5. Use Cartesian coordinates to determine distance, midpoint, and slope
- 9-10.2.6. Use distance, midpoint, and slope to establish relationships between points, lines, and plane figures in the Cartesian coordinate system; e.g., determine whether a triangle is scalene, isosceles, or equilateral given the coordinates of its vertices

TRANSFORMATION AND SYMMETRY

- 9-10.2.7. Identify and perform transformations of objects in the plane using sketches (translations, reflections, rotations, and dilations) and coordinates (translations, reflections, and dilations)
- 9-10.2.8. Analyze the effects of combining basic transformations in a plane; e.g., two reflections over parallel lines results in a translation

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

- 9-10.2.9. Construct plane figures using traditional and/or technological tools; i.e., congruent segments, congruent angles, angle and segment bisectors, perpendicular and parallel lines
- 9-10.2.10. Given a two-dimensional image of a three-dimensional object, recognize images of the same object shown from different perspectives

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

9-10.2.11. Use geometric models to gain insights into, and to answer questions in, other areas of mathematics, other disciplines, and other areas of interest; e.g., art and architecture

Standard 3: Data Analysis, Statistics, and Probability

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

Grades 9-10

DATA COLLECTION, DISPLAY, AND INTERPRETATION

- 9-10.3.1. Construct appropriate displays of given data; i.e., circle graphs, bar graphs, histograms, stem-and-leaf plots, box-and-whisker plots, and scatter plots
- 9-10.3.2. Interpret a given visual representation (i.e., circle graphs, bar graphs, histograms, stem-and-leaf plots, box-and-whisker plots, and scatter plots) of a set of data
- 9-10.3.3. Identify the variable, sample, and population in a well-designed study; e.g., in an exit poll for a tax increase, the variable is the outcome of the vote, the sample is the set of people surveyed, the population is the set of all voters

PROBABILITY

- 9-10.3.4. Determine the number of possible outcomes for a given event, using appropriate counting techniques; e.g., fundamental counting principle, factorials, combinations, permutations
- 9-10.3.5. Calculate experimental and theoretical probabilities with and without replacement
- 9-10.3.6. Calculate probabilities of compound events using addition and multiplication rules

STATISTICAL METHODS

- 9-10.3.7. Calculate measures of central tendency and spread; i.e., mean, median, mode, range, and quartiles
- 9-10.3.8. Discuss relationships among measures of central tendency and spread; i.e., mean, median, mode, range, and quartiles

PREDICTIONS, DATA ANALYSIS AND INFERENCES

- 9-10.3.9. Select two points and approximate an equation for the line of best fit (if appropriate) for a set of data
- 9-10.3.10. Identify the trend of the data and estimate the strength of the correlation between two variables; e.g., strong vs. weak, positive vs. negative

Standard 4: Measurement

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

Grades 9-10

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 9-10.4.1. Select appropriate units and scales for problem situations involving measurement
- 9-10.4.2. Describe the effects of scalar change on the area and volume of a figure; e.g., the effect of doubling one or more edges of a solid on its surface area and volume
- 9-10.4.3. Use approximations to compare the standard and metric systems of measurement; e.g., a five-kilometer race is about three miles long
- 9-10.4.4. Given a conversion factor, convert between standard and metric measurements

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 9-10.4.5. Use methods necessary to achieve a specified degree of precision and accuracy (i.e., appropriate number of significant digits) in measurement situations
- 9-10.4.6. Employ estimation techniques to evaluate reasonableness of results in measurement situations
- 9-10.4.7. Use unit analysis to track units during computations
- 9-10.4.8. Given a formula list, compute the area of a regular polygon
- 9-10.4.9. Given a formula list, compute the surface area and volume of a right prism, right cylinder, right pyramid, right cone, and sphere
- 9-10.4.10. Apply indirect measurement techniques to solve problems involving irregular shapes or inaccessible objects; e.g., calculate the distance across a lake, triangulate an irregular region to find its approximate area

Standard 5: Algebra, Functions, and Patterns

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Grades 9-10

PATTERNS, RELATIONS, AND FUNCTIONS

- 9-10.5.1. Given the explicit and/or the recursive definition of a sequence, generate a specific term (explicit formula only) or a specified number of terms
- 9-10.5.2. Express relations and functions using a variety of representations; i.e., numeric, graphic, symbolic, and verbal
- 9-10.5.3. Determine whether a relation is a function by examining various representations of the relation; e.g., table, graph, equation, set of ordered pairs
- 9-10.5.4. Perform the operations of addition, subtraction, multiplication, and division on algebraic functions; e.g., given $f(x) = 2x$ and $g(x) = 5x - 7$, find $f(x) + g(x)$
- 9-10.5.5. Identify the independent variable, dependent variable, domain, and range of a function
- 9-10.5.6. Draw graphs of linear and quadratic functions using paper and pencil, labeling key features; e.g., graph a line and label its x-intercept and y-intercept, graph a parabola and label its vertex and one point on each side of the vertex

NUMERIC AND ALGEBRAIC REPRESENTATIONS

- 9-10.5.7. Develop algebraic expressions or equations involving one or two variables to represent relationships found in various contexts (time and distance problems, mixture problems, etc.); e.g., given a verbal statement, write an equivalent algebraic expression or equation
- 9-10.5.8. Manipulate algebraic expressions and equations using properties of real numbers; e.g., simplify, factor
- 9-10.5.9. Solve linear equations and inequalities, systems of two linear equations or inequalities, and quadratic equations having rational solutions; e.g., factoring, quadratic formula
- 9-10.5.10. Solve a literal equation for a specified variable; e.g., solve $I = prt$ for r , or solve $7n + p = t$ for n

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems**BENCHMARK EXPECTATION****MATHEMATICAL MODELING**

- 9-10.5.11. Use essential quantitative relationships in a situation to determine whether the relationship can be modeled by a linear function; e.g., simple interest is linear, compound interest is not linear
- 9-10.5.12. Graphically represent the solution or solutions to an equation, inequality, or system
- 9-10.5.13. Interpret a graphical representation of a real-world situation
- 9-10.5.14. Draw conclusions about a situation being modeled

RATES OF CHANGE

- 9-10.5.15. Approximate and interpret rates of change from graphical and numerical data