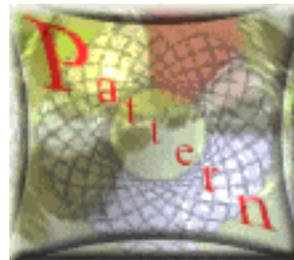


Mathematics STANDARD 3



[MST Standards](#)

Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.



Alternate Assessment Standards for Students with Severe Disabilities

Standard 1: [Mathematical Analysis](#)

Standard 3: [Number and Numeration](#)

Standard 3: [Measurement](#)

Standard 3: [Patterns and Functions](#)

Standard 3 Mathematics

Mathematical Reasoning

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **MATHEMATICAL REASONING** to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Performance Indicators--Students will:

Elementary

- use models, facts, and relationships to draw conclusions about mathematics and explain their thinking
- use patterns and relationships to analyze mathematical situations
- justify their answers and solution processes
- use logical reasoning to reach simple conclusions

Intermediate

- apply a variety of reasoning strategies
- make and evaluate conjectures and arguments using appropriate language
- make conclusions based on inductive reasoning
- justify conclusions involving simple and compound (i.e., and/or) statements

Commencement

- construct simple logical arguments
- follow and judge the validity of logical arguments
- use symbolic logic in the construction of valid arguments
- construct proofs based on deductive reasoning

Four-Year Sequence Commencement

- construct indirect proofs or proofs using mathematical induction
- investigate and compare the axiomatic structures of various geometries

Standard 3 Mathematics

Number Sense & Numeration

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **NUMBER SENSE AND NUMERATION** to develop an understanding of multiple uses of numbers in the real world, use of numbers to communicate mathematically, and use of numbers in the development of mathematical ideas.

Performance Indicators--Students will:

Elementary

- use whole numbers and fractions to identify locations, quantify groups of objects, and measure distances
- use concrete materials to model numbers and number relationships for whole numbers and common fractions, including decimal fractions
- relate counting to grouping and to place-value
- recognize the order of whole numbers and commonly used fractions and decimals
- demonstrate the concept of percent through problems related to actual situations

Intermediate

- understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, expanded and scientific notation)
- understand and apply ratios, proportions, and percents through a wide variety of hands-on explorations
- develop an understanding of numbered theory (primes, factors, and multiples)
- recognize order relations for decimals, integers, and rational numbers

Commencement

- understand and use rational and irrational numbers
- recognize the order of real numbers
- apply the properties of the real numbers to various subsets of numbers

Four-Year Sequence Commencement

- understand the concept of infinity
- recognize the hierarchy of the complex number system
- model the structure of the complex number system
- recognize when to use and how to apply the field properties

Standard 3 Mathematics

Mathematical Operations & Relationships

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **MATHEMATICAL OPERATIONS and RELATIONSHIPS** among them to understand mathematics.

Performance Indicators--Students will:

Elementary

- add, subtract, multiply, and divide whole numbers
- develop strategies for selecting the appropriate computational and operational method in problem-solving situations
- know single digit addition, subtraction, multiplication, and division facts
- understand the commutative and associative properties

Intermediate

- add, subtract, multiply, and divide fractions, decimals, and integers
- explore and use the operations dealing with roots and powers
- use grouping symbols (parentheses) to clarify the intended order of operations
- apply the associative, commutative, distributive, inverse, and identity properties
- demonstrate an understanding of operational algorithms (procedures for adding, subtracting, etc.)
- develop appropriate proficiency with facts and algorithms
- apply concepts of ratio and proportion to solve problems

Commencement

- use addition, subtraction, multiplication, division, and exponentiation with real numbers and algebraic expressions
- develop an understanding of and use the composition of functions and transformations
- explore and use negative exponents on integers and algebraic expressions
- use field properties to justify mathematical procedures
- use transformations on figures and functions in the coordinate plane

Four-Year Sequence Commencement

- use appropriate techniques, including graphing utilities, to perform basic operations on matrices
- use rational exponents on real numbers and all operations on complex numbers
- combine functions using the basic operations and the composition of two functions

Standard 3 Mathematics

Mathematical Modeling/ Multiple Representation

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **MATHEMATICAL MODELING/MULTIPLE REPRESENTATION** to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships.

Performance Indicators--Students will:

Elementary

- use concrete materials to model spatial relationships
- construct tables, charts, and graphs to display and analyze real-world data
- use multiple representations (simulations, manipulative materials, pictures, and diagrams) as tools to explain the operation of everyday procedures
- use variables such as height, weight, and hand size to predict changes over time
- use physical materials, pictures, and diagrams to explain mathematical ideas and processes and to demonstrate geometric concepts

Intermediate

- visualize, represent, and transform two- and three-dimensional shapes
- use maps and scale drawings to represent real objects or places
- use the coordinate plane to explore geometric ideas
- represent numerical relationships in one- and two-dimensional graphs
- use variables to represent relationships
- use concrete materials and diagrams to describe the operation of real world processes and systems
- develop and explore models that do and do not rely on chance
- investigate both two- and

Commencement

- represent problem situations symbolically by using algebraic expressions, sequences, tree diagrams, geometric figures, and graphs
- manipulate symbolic representations to explore concepts at an abstract level
- choose appropriate representations to facilitate the solving of a problem
- use learning technologies to make and verify geometric conjectures
- justify the procedures for basic geometric constructions
- investigate transformations in the coordinate plane
- develop meaning for basic conic sections

three-dimensional transformations

• develop and apply the concept of basic loci to compound loci

• use appropriate tools to construct and verify geometric relationships

• use graphing utilities to create and explore geometric and algebraic models

• develop procedures for basic geometric constructions

• model real-world problems with systems of equations and inequalities

Four-Year Sequence Commencement

- model vector quantities both algebraically and geometrically
- represent graphically the sum and difference of two complex numbers
- model and solve problems that involve absolute value, vectors, and matrices
- model quadratic inequalities both algebraically and graphically
- model the composition of transformations
- determine the effects of changing parameters of the graphs of functions
- use polynomial, rational, trigonometric, and exponential functions to model real-world relationships
- use algebraic relationships to analyze the conic sections
- use circular functions to study and model periodic real-world phenomena
- illustrate spatial relationships using perspective, projections, and maps
- represent problem situations using discrete structures such as finite graphs, matrices, sequences, and recurrence relations
- analyze spatial relationships using the Cartesian coordinate system in three dimensions

Standard 3 Mathematics

Measurement

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **MEASUREMENT** in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data.

Performance Indicators--Students will:

Elementary

Intermediate

Commencement

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • understand that measurement is approximate, never exact • select appropriate standard and nonstandard measurement tools in measurement activities • understand the attributes of area, length, capacity, weight, volume, time, temperature, and angle • estimate and find measures such as length, perimeter, area, and volume using both nonstandard and standard units • collect and display data • use statistical methods such as graphs, tables, and charts to interpret data | <ul style="list-style-type: none"> • estimate, make, and use measurements in real-world situations • select appropriate standard and nonstandard measurement units and tools to measure to a desired degree of accuracy • develop measurement skills and informally derive and apply formula in direct measurement activities • use statistical methods and measures of central tendencies to display, describe, and compare data • explore and produce graphic representations of data using calculators/ computers • develop critical judgment for the reasonableness of measurement | <ul style="list-style-type: none"> • derive and apply formulas to find measures such as length, area, volume, weight, time, and angle in real-world contexts • choose the appropriate tools for measurement • use dimensional analysis techniques • use statistical methods including measures of central tendency to describe and compare data • use trigonometry as a method to measure indirectly • apply proportions to scale drawings, computer-assisted design blueprints, and direct variation in order to compute indirect measurements • relate absolute value, distance between two points, and the slope of a line to the coordinate |
|---|--|--|

plane

- understand error in measurement and its consequence on subsequent calculations

- use geometric relationships in relevant measurement problems involving geometric concepts

Four-Year Sequence Commencement

- derive and apply formulas relating angle measure and arc degree measure in a circle
- prove and apply theorems related to lengths of segments in a circle
- define the trigonometric functions in terms of the unit circle
- relate trigonometric relationships to the area of a triangle and to the general solutions of triangles
- apply the normal curve and its properties to familiar contexts
- design a statistical experiment to study a problem and communicate the outcomes, including dispersion
- use statistical methods, including scatter plots and lines of best fit, to make predictions
- apply the conceptual foundation of limits, infinite sequences and series, the area under a curve, rate of change, inverse variation, and the slope of a tangent line to authentic problems in mathematics and other disciplines
- determine optimization points on a graph
- use derivatives to find maximum, minimum, and inflection points of a function

Standard 3 Mathematics

Ideas of Uncertainty

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **IDEAS of UNCERTAINTY** to illustrate that mathematics involves more than exactness when dealing with everyday situations.

Performance Indicators--Students will:

Elementary

Intermediate

Commencement

- make estimates to compare to actual results of both formal and informal measurement
- make estimates to compare to actual results of computations
- recognize situations where only an estimate is required
- develop a wide variety of estimation skills and strategies
- determine the reasonableness of results
- predict experimental probabilities
- make predictions using unbiased random samples
- determine probabilities of simple events

- use estimation to check the reasonableness of results obtained by computation, algorithms, or the use of technology
- use estimation to solve problems for which exact answers are inappropriate
- estimate the probability of events
- use simulation techniques to estimate probabilities
- determine probabilities of independent and mutually exclusive events

- judge the reasonableness of results obtained from applications in algebra, geometry, trigonometry, probability, and statistics
- judge the reasonableness of a graph produced by a calculator or computer
- use experimental or theoretical probability to represent and solve problems involving uncertainty
- use the concept of random variable in computing probabilities
- determine probabilities using permutations and combinations

Four-Year Sequence Commencement

- interpret probabilities in real-world situations
- use a Bernoulli experiment to determine probabilities for experiments with exactly two outcomes
- use curve fitting to predict from data
- apply the concept of random variable to generate and interpret probability distributions
- create and interpret applications of discrete and continuous probability distributions
- make predictions based on interpolations and extrapolations from data
- obtain confidence intervals and test hypotheses using appropriate statistical methods
- approximate the roots of polynomial equations

Standard 3 Mathematics

Patterns and Functions

Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use **PATTERNS and FUNCTIONS** to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.

Performance Indicators--Students will:

Elementary

Intermediate

Commencement

- recognize, describe, extend, and create a wide variety of patterns
- represent and describe mathematical relationships
- explore and express relationships using variables and open sentences
- solve for an unknown using manipulative materials
- use a variety of manipulative materials and technologies to explore patterns
- interpret graphs
- explore and develop relationships among two- and three-dimensional geometric shapes
- discover patterns in nature, art, music, and literature

- recognize, describe, and generalize a wide variety of patterns and functions
- describe and represent patterns and functional relationships using tables, charts and graphs, algebraic expressions, rules, and verbal descriptions
- develop methods to solve basic linear and quadratic equations
- develop an understanding of functions and functional relationships: that a change in one quantity (variable) results in change in another
- verify results of substituting variables
- apply the concept of similarity in relevant situations
- use properties of polygons to classify them

- use function vocabulary and notation
- represent and analyze functions using verbal descriptions, tables, equations, and graphs
- translate among the verbal descriptions, tables, equations and graphic forms of functions
- analyze the effect of parametric changes on the graphs of functions
- apply linear, exponential, and quadratic functions in the solution of problems
- apply and interpret transformations to functions
- model real-world situations with the appropriate function
- apply axiomatic structure to algebra and geometry

- explore relationships involving points, lines, angles, and planes
- use computers and graphing calculators to analyze mathematical phenomena
- develop and apply the Pythagorean principle in the solution of problems
- explore and develop basic concepts of right triangle trigonometry
- use patterns and functions to represent and solve problems

Four-Year Sequence Commencement

- solve equations with complex roots using a variety of algebraic and graphical methods with appropriate tools
- understand and apply the relationship between rectangular form and polar form of a complex number
- evaluate and form the composition of functions
- use the definition of a derivative to examine properties of a function
- solve equations involving fractions, absolute values, and radicals
- use basic transformations to demonstrate similarity and congruence of figures
- identify and differentiate between direct and indirect isometries
- analyze inverse functions using transformations
- apply ideas of symmetries in sketching and analyzing graphs of functions
- use the normal curve to answer questions about data
- develop methods to solve trigonometric equations and verify trigonometric functions
- describe patterns produced by processes of geometric change, formally connecting iteration, approximations, limits, and fractals
- extend pattern and compute the n th term in numerical and geometric sequences
- use the limiting process to analyze infinite sequences and series
- use algebraic and geometric iteration to explore patterns and solve problems
- solve optimization problems
- use linear programming and difference equations in the solution of problems

STANDARD 1

Analysis, Inquiry and Design



Mathematical Analysis

Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers and develop solutions.

Key Idea: Symbolic representation is used to communicate mathematically.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

- use mathematics and symbolism to communicate in mathematics
 - compare and describe quantities
 - demonstrate knowledge of mathematical relationships
 - relate mathematics to their immediate environment
-

STANDARD 3

Number Sense & Numeration

Mathematics



Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use number sense and numeration to communicate mathematically and use numbers in the development of concrete mathematical ideas.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

- use single digit whole numbers to identify locations, quantify groups of objects, and measure distances
 - use concrete materials to model numbers and number relationships for whole numbers and simple fractions
 - relate counting to grouping using manipulatives
 - recognize the order of whole numbers up to 12 and commonly used simple fractions
 - recognize coins and dollars and their value
-

STANDARD 3

Measurement

Mathematics



Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use measurement in real-world situations.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

- use appropriate standard and nonstandard measurement tools in measurement activities
 - understand the simple attributes of length, weight, volume, time, and temperature
 - measure the length or volume of an object
 - collect and display simple data
-

STANDARD 3

Patterns and Functions

Mathematics



Students will: understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Key Idea: Students use mathematical patterns in a real-world situation.

ALTERNATE ASSESSMENT

Performance Indicators--Students:

- recognize and duplicate simple patterns
 - use a variety of manipulative materials and technologies to explore patterns
 - recognize simple patterns in nature, art, music, and literature
-