PERFORMANCE STANDARDS FOR MATH: GRADE 6

A. Mathematical Processes

Content Standard: Students in Wisconsin will draw on a broad body of mathematical knowledge and apply a variety of mathematical skills and strategies, including reasoning, oral and written communication and the use of appropriate technology, when solving mathematical, real-world* and non-routine* problems.

Rationale: In order to participate fully as a citizen and a worker in our contemporary world, a person should be mathematically powerful. Mathematical power is the ability to explore, to conjecture, to reason logically and to apply a wide repertoire of methods to solve problems. Because no one lives and works in isolation, it is also important to have the ability to communicate mathematical ideas clearly and effectively.

Performance Standard

A.8.1 Use reasoning abilities to:

- evaluate information
- perceive patterns
- identify relationships
- formulate questions for further exploration
- evaluate strategies
- justify statements
- test reasonableness of results
- defend work

6th Grade

1. Use reasoning abilities to:
   - perceive patterns (congruent, similar, divisibility, L.C.M., G.C.F., prime factorization, comparing and ordering, sequence) _____
   - identify relationships (ratio and proportion) _____
   - evaluate information (too much, not enough, what do you need to use) _____
2. Use reasoning abilities to:
   - design questions that will help with further research _____
   - justify a statement using logical reasoning by explaining processes used to arrive at the answer _____
   - test reasonableness of results through estimation, sampling _____
   - to defend work by using the four-step process (explore, plan, solve, examine)_____
3. Apply the following problem-solving strategies:

_____ choose an operation	_____ draw a diagram
_____ use manipulatives	_____ guess and check
_____ make a chart/table/list	_____ use estimation
_____ work backwards	_____ note important information
_____ use a calculator	_____ identify needed/extra information
_____ find a pattern	_____ use a graph
_____ use an equation	_____ use a formula
_____ solve a simpler problem	_____ classify
_____ eliminate possibilities	_____ Venn diagrams

4. Justify strategies and solutions through oral and written explanations. _____

Performance Standard

A.8.2 Communicate logical arguments clearly to show why a result makes sense.

6th Grade

1. Communicate logical arguments clearly to show why a result makes sense using words, numbers, pictures, symbols, charts, graphs, tables, diagrams, models. _____
2. Know when to use the appropriate resource/strategy. _____
3. Justify logical arguments through oral and written explanation. _____

Performance Standard

A.8.3 Analyze non-routine* problems by modeling*, illustrating, guessing, simplifying, generalizing, shifting to another point of view, etc.

6th Grade

1. Analyze non-routine problems by illustrating, guessing, simplifying, relating to everyday life, modeling, and acting it out. _____
2. Use mathematics as a way to understand other areas of the curriculum (e.g. measurement in science, geography skills in social studies, and Venn diagrams in language arts). _____
3. See relationships between various kinds of problems and actual events. _____

Performance Standard

A.8.4 Develop effective oral and written presentations that include:

- appropriate use of technology
- the conventions of mathematical discourse (e.g., symbols, definitions, labeled drawings)
- mathematical language
- clear organization of ideas and procedures
- understanding of purpose and audience

6th Grade

1. Exercise and apply what they know in written form by using a journal. _____
2. Calculators – a learner will apply the following: scientific calculators. _____
3. Computers – a learner will apply the following: spreadsheet tool; graphing tool; geometry tool; internet access. _____
4. The learner will determine when technology is appropriate and when other approaches are more appropriate or efficient. _____
5. Present results of a project, written and oral, to an audience. _____

Performance Standard

A.8.5 Explain mathematical concepts, procedures, and ideas to others who may not be familiar with them.

6th Grade

1. Communications – The learner will explain and demonstrate mathematical concepts, procedures and ideas to others by reading, talking about it, sharing and assisting others.

   * think/pair/share _____
   * study buddies _____
   * peer tutoring _____
   * cooperative groups _____

Performance Standard

A.8.6 Read and understand mathematical texts and other instructional materials and recognize mathematical ideas as they appear in other contexts.

6th Grade

1. Curriculum connections: social studies/history/geography; health/physical education; science; music; language arts; art; and electives. _____
2. Real-world connections: the learner will use real-world connections as they apply in daily life, careers, as consumers and in multicultural situations. _____

Vocabulary

6th Grade

_____ divisibility
_____ equation
_____ formula
_____ four-step process
_____ prime factorization
_____ proportion
_____ ratio
_____ sampling
_____ similar

B. Number Operations and Relationships

Content Standard: Students in Wisconsin will use numbers effectively for various purposes, such as counting, measuring, estimating and problem solving.

Rationale: People use numbers to quantify, describe and label things in the world around them. It is important to know the many uses of numbers and various ways of representing them. Number sense is a matter of necessity, not only in one's occupation but also in the conduct of daily life, such as shopping, cooking, planning a budget or analyzing information reported in the media. When computing, an educated person needs to know which operations (e.g., addition, multiplication), which procedures (e.g., mental techniques, algorithms*), or which technological aids (e.g., calculator, spreadsheet) are appropriate.

Performance Standard:

B.8.1 Read, represent and interpret various rational numbers* (whole numbers*, decimals, fractions and percents) with verbal descriptions, geometric models* and mathematical notation (e.g., expanded*, scientific*, exponential*).

6th Grade

1. Read and write and demonstrate numbers through the trillions. _____
2. Read, write and demonstrate decimals through the ten-thousandths. _____
3. Read, write and demonstrate fractions. _____
4. Illustrate and interpret the meaning of percents using models. _____
5. Identify, name and graph decimals, fractions and integers on a number line._____
6. Use powers and exponents in expressions. _____

Performance Standard:

B.8.2 Perform and explain operations on rational* numbers (add, subtract, multiply, divide, raise to a power, extract a root, take opposites and reciprocals, determine absolute value).

6th Grade

1. Add and subtract decimals, fractions with like and unlike denominators, mixed numbers, measures of time and integers. _____
2. Multiply and divide: whole numbers, decimals, fractions, mixed numbers and integers. _____
3. Solve for, as well as write, powers and positive exponents in expressions. _____
4. Introduce numerical and algebraic expressions using order of operations. _____
5. Introduce two-step equations using formulas. _____
6. Recall of multiplication and division facts 0-12. _____

Performance Standard

B.8.3 Generate and explain equivalences among fractions, decimals and percents.

B. Number Operations and Relationships

6th Grade

1. Be introduced to and express fractions as terminating and repeating decimals. _____
2. Be introduced to and express terminating decimals as fractions in simplest form. _____
3. Express percents as fractions and vice versa. _____
4. Express percents as decimals and vice versa. _____
5. Estimate the percents of numbers. _____
6. Find the percent of a number. _____
7. Express fractions in simplest form. _____
8. Express mixed numbers as improper fractions and vice versa using numbers and models. _____

Performance Standard:

B.8.4 Express order relationships among rational numbers using appropriate symbols (>, <, <, >, =).

6th Grade

1. Compare and order fractions, decimals and integers using <, >, =. _____
2. Determine whether a pair of ratios forms a proportion by using cross products (= or =/). _____
3. Solve proportions by using cross products. _____

Performance Standard:

B.8.5 Apply proportional thinking in a variety of problem situations that include, but are not limited to:

- ratios and proportions (e.g., rates, scale drawings*, similarity*)
- percents including those greater than 100 and less than one (e.g., discounts, rate of increase or decrease, sales tax)

6th Grade

1. Express ratios and rates as fractions. _____
2. Solve proportions by using cross products. _____
3. Find actual length from a scale drawing and vice versa. _____
4. Express percents as fractions and vice versa. _____
5. Express percents as decimals and vice versa. _____
6. Estimate the percent of a number. _____
7. Find the percent of a number. _____

Performance Standard:

B.8.6 Model* and solve problems involving number-theory concepts such as:

- prime* and composite numbers
- divisibility and remainders
- greatest common factors
- least common multiples

B. Number Operations and Relationships

6th Grade

1. Find the prime factorization of a composite number. _____
2. Use the divisibility rules for 2, 3, 5, 6, 9, and 10. _____
3. Find the greatest common factor of two or more numbers. _____
4. Find the least common multiple of two or more numbers. _____
5. Dividing whole numbers and repeating and terminating rational decimals. _____

Performance Standard:

B.8.7 In problem-solving situations, select and use appropriate computational procedures with rational numbers such as:

- calculating mentally
- estimating
- using technology (e.g., scientific calculators, spreadsheets)

6th Grade

1. Estimate addition, subtraction, multiplication and division using rounding or patterns. _____
2. Estimate addition and subtraction using front-end estimation. _____
3. Estimate quotients using compatible numbers. _____
4. Problem solving strategies:
   Classify information, guess and check, use a graph, make a table, determine reasonable answers, use a formula, solve a simpler problem, choose the method of computation, make a list, eliminate possibilities, find a pattern, use logical reasoning, draw a diagram, make a model, work backward, use an equation and not enough information is present. _____

Vocabulary

6th Grade

_____ composite numbers	_____ denominator	_____ dividend
_____ division	_____ divisor	_____ estimation
_____ equivalent fractions	_____ expanded form	_____ expressions
_____ factor	_____ factor tree	_____ mental math
_____ greatest common factor (GCF)	_____ mixed numbers	_____ multiple
_____ least common multiple (LCM)	_____ order of operations	_____ numerator
_____ percent	_____ prime factorization	_____ prime numbers
_____ probability	_____ proportion	_____ quotient
_____ ratio	_____ rational numbers	_____ reciprocals
_____ regrouping	_____ rounding off	_____ short word form
_____ simplest form	_____ standard form	_____ technology

C. Geometry

Content Standard: Students in Wisconsin will be able to use geometric concepts, relationships and procedures to interpret, represent and solve problems.

Rationale: Geometry and its study of shapes and relationships is an effort to understand the nature and beauty of the world. While the need to understand our environment is still with us, the rapid advance of technology has created another need: to understand ideas communicated visually through electronic media. For these reasons, educated people in the 21st century need a well-developed sense of spatial order to visualize and model real world* problem situations.

Performance Standard

C.8.1 Describe special and complex two- and three-dimensional figures (e.g., rhombus, polyhedron, cylinder) and their component parts (e.g., base, altitude and slant height) by:

- naming, defining and giving examples
- comparing, sorting and classifying them
- identifying and contrasting their properties (e.g., symmetrical, isosceles, regular)
- drawing and constructing physical models to specifications
- explaining how these figures are related to objects in the environment

6th Grade

1. Identify and draw points, line segments, line rays, perpendicular lines, parallel lines, and intersecting lines. _____
2. Draw and construct physical models to specifications by using a compass, protractor, and straight edge. _____
3. Describe and classify angles and triangles (equilateral, isosceles, scalene, acute, obtuse and right). _____
4. Identify and classify polygons (three-sided through n-sided). _____
5. Construct polygons with a specified number of sides. _____
6. Identify and draw congruent, similar and symmetrical figures. _____
7. Construct and identify the parts of a circle including diameter and radius. _____
8. Analyze three-dimensional objects by counting their faces, edges and vertices. _____
9. Analyze, select and present examples of three-dimensional figures in real-life settings. _____

Performance Standard:

C.8.2 Identify and use relationships among the component parts of special and complex 2- and 3-dimensional figures (e.g., parallel sides, congruent* faces).

6th Grade

1. Distinguish the difference between regular and irregular polygons. _____
2. Calculate the third angle given the measurement of two angles of a triangle. _____
3. Analyze three-dimensional objects by counting their faces, edges and vertices. _____

C. Geometry

Performance Standard:

C.8.3 Identify 3-dimensional shapes from 2-dimensional perspectives and draw 2-dimensional sketches of 3-dimensional objects preserving their significant features.

6th Grade

1. Draw and construct physical models. _____

Performance Standard:

C.8.4 Perform transformations* on 2-dimensional figures and describe and analyze the effects of the transformations on the figures.

6th Grade

1. Describe the effects of slides, flips and turns of 2-dimensional figures. _____
2. Create tessellations. _____

Performance Standard:

C.8.5 Locate objects using the rectangular coordinate system*.

- Employ technology to demonstrate the rectangular coordinate system when grade appropriate.

6th Grade

1. Identify ordered pairs using the rectangular coordinate system. _____
2. Identify and graph the transformations or movements of geometric figures shown on a coordinate grid. _____
3. Locate and examine points on a map using a grid system. _____

Vocabulary

6th Grade

_____ acute triangle
_____ base
_____ corresponding parts
_____ end point
_____ equilateral triangle
_____ regular polygon
_____ net
_____ rotation
_____ pi
_____ polyhedra
_____ quadrant
_____ rectangular prism
_____ reflection
_____ horizontal axis
_____ right triangle
_____ origin
_____ symmetry
_____ straight angle
_____ translation
_____ vertical axis
_____ face
_____ rhombus
_____ obtuse triangle
_____ rotational

D. Measurement

Content Standard: Students in Wisconsin will select and use appropriate tools (including technology) and techniques to measure things to a specified degree of accuracy. They will use measurements in problem-solving situations.

Rationale: Measurement is the foundation upon which much technological, scientific, economic and social inquiry rests. Before things can be analyzed and subjected to scientific investigation, or mathematical modeling*, they must first be quantified by appropriate measurement principles. Measurable attributes* include such diverse concepts as voting preferences, consumer price indices, speed and acceleration, length, monetary value, duration of an Olympic race, or probability of contracting a fatal disease.

Performance Standard:

D.8.1 Identify and describe attributes* in situations where they are not directly* or easily measurable (e.g., distance, area of an irregular figure, likelihood of occurrence).

6th Grade

1. Find irregular figures located in the school and estimate area of each. _____
2. Determine appropriate tools and accurately measure length and mass. _____
3. Explain the process and results of steps 2 and 3 to the class in written and oral reports. _____
4. Use at least one technology (word processing, calculators, power point, overheads, graphics, photography, etc.) in the written and oral reports.

Performance Standard

D.8.2 Demonstrate understanding of basic measurement facts, principles and techniques including the following:

- approximate comparisons between metric and US customary units (e.g., a liter and a quart are about the same; a kilometer is about six-tenths of a mile.)
- knowledge that direct measurement* produces approximate, not exact, measures.
- the use of smaller units to produce more precise measures.
- employment of appropriate grade level technology.

6th Grade

1. Compare and contrast metric and customary units of measure. _____
2. Demonstrate that each unit of measurement is part of another either smaller or larger unit. _____
3. Construct a model to demonstrate that direct measurement produces approximate, not exact, measures. _____

D. Measurement

Performance Standard

D.8.3 Determine measurement directly* using standard units (metric and US customary) with these suggested degrees of accuracy:

- lengths to the nearest mm or 1/16 of an inch
- weight (mass) to the nearest 0.1 g or 0.5 ounce
- liquid capacity to the nearest ml
- angles to the nearest degree
- temperature to the nearest Centigrade and Fahrenheit degree
- elapsed time to the nearest second

6th Grade

1. Determine measurements to the following degrees of accuracy:
   - length to the nearest eighth, quarter, half-inch, foot, yard, millimeter, centimeter, meter _____
   - weight to the nearest ounce, pound, gram, and kilogram _____
   - temperature to the nearest degree in Celsius and Fahrenheit _____
   - time to the nearest second _____
   - liquid capacity to the nearest ounce, cup, pint, quart, half-gallon, gallon, milliliter, liter, and fluid ounce _____
   - angles to the nearest degree. _____
2. Determine appropriate units to measure length, mass, temperature, capacity and time. ___
3. Apply measurement skills to real life problems. _____

Performance Standard

D.8.4 Determine measurements indirectly* using:

- estimation
- conversion of units within a system (e.g., quarts to cups, millimeters to centimeters)
- ratio and proportion (e.g., similarity*, scale drawings*)
- geometric formulas to derive lengths, areas, volumes of common figures (e.g., perimeter, circumference, surface area)
- the Pythagorean* relationship
- geometric relationships and properties for angle size (e.g., parallel lines and trans-versals; sum of angles of a triangle, vertical angles*)

6th Grade

1. Estimate measurement indirectly by using non-standard units. _____
2. Convert units within metric/customary systems. _____
3. Apply geometric formulas to calculate:
   - perimeter and circumference. _____
   - area of triangles, quadrilaterals, and circles. _____
   - surface area and volume of rectangular prisms. _____
4. Solve basic rate problems (unit price, distance per unit of time). _____
5. Create ratio and proportion/scale drawings. _____
6. Apply measurement skills to real life problems. _____

D. Measurement

Vocabulary

6th Grade

_____ base (of parallelogram)
_____ Metric system
_____ conversion factor
_____ pound
_____ fluid ounce
_____ rate
_____ supplementary angle
_____ yard
_____ irregular figure
_____ circumference
_____ ounce
_____ degree
_____ quart
_____ gallon
_____ height
_____ complementary angle
_____ mile
_____ cubic units
_____ protractor
_____ foot
_____ scale drawing
_____ inch

E. Statistics and Probability

Content Standard: Students in Wisconsin will use data collection and analysis, statistics and probability in problem solving situations, employing technology where appropriate.

Rationale: Dramatic advances in technology have launched the world into the Information Age, when data are used to describe past events or predict future events. Whether in the business place or in the home, as producers or consumers of information, citizens need to be well versed in the concepts and procedures of data analysis in order to make informed decisions.

Performance Standard

E.8.1. Work with data in the context of real-world situations by:

- formulating questions that lead to data collection and analysis
- designing and conducting a statistical investigation
- using technology to generate displays, summary statistics* and presentations

6th Grade

1. Collect, organize and record real-world data. _____
2. Conduct surveys, experiments or simulations and display results. _____
3. Formulate questions and determine the appropriate data to collect and how to collect data. _____
4. Draw reasonable conclusions about real-world data. _____
5. Use technology to produce a simple database. _____
6. Explore the uses of a computer database. _____

Performance Standard

E.8.2 Organize and display data from statistical investigations using:

- appropriate tables, graphs and/or charts (e.g., circle, bar, or line, for multiple sets of data)
- appropriate plots (e.g., line*, stem-and-leaf*, box*, scatter*)

6th Grade

1. Gather and organize data into a table. _____
2. Construct bar graphs, line graphs and circle graphs. _____
3. Construct a simple line plot. _____
4. Create story problems based on collected data for classmates to solve. _____

Performance Standard

E.8.3 Extract, interpret and analyze information from organized and displayed data by using:

- frequency and distribution, including mode* and range*
- central tendencies* of data (mean* and median*)
- indicators of dispersion (e.g., outliers*)

E. Statistics and Probability

6th Grade

1. Predict and calculate the mean, median, mode and range from a set of data. _____
2. Analyze information based on frequency and distribution. _____
3. Assess and select the appropriate scale and interval for graphs or frequency tables. _____
4. Examine the effect of extreme values on measures of central tendency. _____
5. Assess and select the best measure of central tendency to represent data. _____
6. Solve data problems by extracting, interpreting, and analyzing data. _____

Performance Standard

E.8.4 Use the results of data analysis to:
- make predictions
- develop convincing arguments
- draw conclusions

6th Grade

1. Predict and draw conclusions from data. _____
2. Analyze data from simple line, bar, and circle graphs. _____
3. Apply results of the data analysis to solve problems. _____
4. Construct and present arguments to support analysis and display of data. _____

Performance Standard

E.8.5 Compare several sets of data to generate, test, and, as the data dictate, confirm or deny hypotheses.

6th Grade

1. Formulate a hypothesis from multiple sets of actual data. _____
2. Analyze the data to determine the criteria that makes the hypothesis true or false. _____
3. Evaluate the data for accuracy. _____
4. Summarize the data on charts and graphs and present to the class. _____

Performance Standard:

E.8.6 Evaluate presentations and statistical analyses from a variety of sources for:
- credibility of the source
- techniques of collection, organization and presentation of data
- missing or incorrect data
- inferences
- possible sources of bias

6th Grade

1. Determine if a source is credible. _____
2. Analyze techniques of organization and presentation. _____
3. Determine if any data is missing or incorrect. _____

Performance Standard:

E.8.7 Determine the likelihood of occurrence of simple events by:

- using a variety of strategies to identify possible outcomes (e.g., lists, tables, tree diagrams*
- conducting an experiment
- designing and conducting simulations*
- applying theoretical notions of probability (e.g., that four equally likely events have a 25% chance of happening)
- employing appropriate grade level technology for presentations

6th Grade

1. Use a variety of strategies to identify possible outcomes (lists, tables, tree diagrams.) _____
2. Design and conduct an experiment. _____
3. Conduct simulations (solve problems by acting them out). _____

Vocabulary

6th Grade

_____ bar graph
_____ central tendency
_____ circle graph
_____ compound event
_____ conclusions
_____ construct
_____ database
_____ even
_____ pictograph
_____ fair
_____ frequency chart
_____ horizontal axis
_____ interval
_____ line plot
_____ multiple sets
_____ outcome
_____ outlier
_____ extreme values
_____ probability
_____ range
_____ simulations
_____ tally
_____ tree diagrams
_____ unfair
_____ vertical axis
_____ experiment
_____ predictions

F. Algebraic Relationships

Content Standard: Students in Wisconsin will discover, describe and generalize simple and complex patterns and relationships. In the context of real-world problem situations, the student will use algebraic techniques to define and describe the problem to determine and justify appropriate solutions.

Rationale: Algebra is the language of mathematics. Much of the observable world can be characterized as having patterned regularity where a change in one quantity results in changes in other quantities. Through algebra and the use of variables* and functions*, mathematical models* can be built which are essential to personal, scientific, economic, social, medical, artistic and civic fields of inquiry.

Performance Standard

F.8.1 Work with algebraic expressions in a variety of ways, including:

- using appropriate symbolism, including exponents* and variables*
- evaluating expressions through numerical substitution
- generating equivalent expressions
- adding and subtracting expressions

6th Grade

1. Use vocabulary symbols and notation of algebra correctly (n,n ,=,<,>). _____
2. Evaluate expressions using order of operations. _____
3. Demonstrate the use of exponents in algebraic expressions. _____
4. Solve problems involving algebraic expressions. _____

Performance Standard

F.8.2 Work with linear and nonlinear patterns* and relationships in a variety of ways, including:

- representing them with tables, with graphs and with algebraic expressions, equations and inequalities
- describing and interpreting their graphical representations (e.g., slope*, rate of change, intercepts*)
- using them as models of real-world phenomena
- describing a real-world phenomenon that a given graph might represent

6th Grade

1. Identify and solve inequalities. _____
2. Complete function tables. _____
3. Graph functions from function tables. _____

F. Algebraic Relationships

Performance Standard

F.8.3 Recognize, describe, and analyze functional relationships* by generalizing a rule that characterizes the pattern of change among variables. These functional relationships include exponential growth and decay (e.g., cell division, depreciation)

6th Grade

Performance Standard

F.8.4 Use linear equations and inequalities in a variety of ways, including:

- writing them to represent problem situations and to express generalizations.
- solving them by different methods (e.g., informally, graphically, with formal properties, with technology).
- writing and evaluating formulas (including solving for a specified variable).
- using them to record and describe solution strategies.

6th Grade

1. Identify and solve linear equations by using mental math and the guess and check strategy (use of a replacement set). _____
2. Solve problems by using a formula. _____
3. Solve linear equations by using inverse operations. _____
4. Solve proportion equations. _____
5. Solve linear equations using models. _____
6. Solve 2-step equations using models. _____
7. Solve problems by writing and solving an equation. _____
8. Use a calculator to solve equations. _____
9. Identify, solve and graph inequalities. _____
10. Solve equations involving addition, subtraction, multiplication and division of fractions/ decimals. _____

Performance Standard

F.8.5 Recognize and use generalized properties and relations, including:

- additive and multiplicative property of equations and inequalities
- commutativity* and associativity* of addition and multiplication
- distributive* property
- inverses* and identities* for addition and multiplication
- transitive* property

F. Algebraic Relationships

6th Grade

1. Recognize, use, and differentiate between the basic properties of arithmetic:
   - Order/Commutative property for +/x. _____
   - Zero property for +/x. _____
   - One/Identity Property for x/÷. _____
   - Inverse property for +/- and x/÷ (12-3=9/9+3=12). _____
   - Property of one for x and ÷. _____
   - Associative property for + and x [5x(3x2)=(5x3)x2]. _____
   - Distributive property. _____

Vocabulary

6th Grade

_____ constant
_____ replacement set
_____ inequality
_____ linear equation
_____ expression