Math Performance Standards
(Grade Level Expectations)
Grade 8

Each PSGLE includes a bolded statement called the "stem." Each stem is the same or similar across the grades for a given PSGLE and is meant to communicate the main curriculum and instructional focus of the PSGLE across the grades.

The first row of each table includes a heading that refers to the content standard, and the second row includes a heading that refers to the performance standard. (The content standard is a broad statement of what students should know; the performance standards state what students should know and be able to do at ages 5-7, 8-10, 11-14, and 15-18.) The second box includes the complete performance standards.

The coding indicates the content strand and the PSGLE number, so PSGLE [6] N-1 is content strand Numeration, and the first PSGLE for that content strand for grade 6.

Content Standard A: Mathematical facts, concepts, principles, and theories
Numeration: Understand and use numeration

Numeration Performance Standards that apply to grade 3: M1.1.1 Read, write, order, count, and model one-to-one correspondence with whole numbers to100. **M1.1.2** Use, model, and identify place value positions of 1's, 10's, and 100's. **M1.1.3** Model and explain the processes of addition and subtraction, describing the relationship between the operations. **M1.1.4** Select and use various representations of ordinal and cardinal numbers. **M1.1.5** Identify, model, and label simple fractions, describing and defining them as equal parts of a whole, a region, or a set. **M1.1.6** Identify, describe, and extend patterns inherent in the number system. Skip count by 2's 5's and 10's. Add and subtract by 10. Identify even and odd numbers. **M1.1.7** Demonstrate the commutative and identity properties of addition.

Numeration Performance Standards that apply to grades 4-6: M1.2.1 Read, write, model, order, and count with positive whole numbers to 1,000,000 and negative whole numbers. **M1.2.2** Use, model, and identify place value positions from 0.001 to 1,000,000. **M1.2.3** Model and explain the processes of multiplication and division. Describe the relationships among the four basic operations. **M1.2.4** Identify and describe different uses for the same numerical representation. **M1.2.5** Model and explain the process of adding and subtracting fractions with common denominators and decimals that represent money. **M1.2.6** Identify and describe factors and multiples including those factors and multiples common to a pair or set of numbers. **M1.2.7** Demonstrate the commutative and identity properties of multiplication.

Understanding Numbers

Grade 3	Grade 4	Grade 5	Grade 6
The student demonstrates conceptual understanding • **of whole numbers to one thousand by** **[3] N-1** reading, writing, ordering, or [counting L] (M1.1.1) **[3] N-2** modeling (base ten blocks) or identifying place value positions to thousands (M1.1.2)	**The student demonstrates conceptual understanding** • **of whole numbers to <u>ten thousands</u> by** **[4] N-1** reading, writing, ordering, or [counting L] (M1.2.1) **[4] N-2** modeling (base ten blocks) or identifying place value positions to <u>ten thousands</u> (M1.2.2)	**The student demonstrates conceptual understanding** • **of whole numbers to <u>millions</u> by** **[5] N-1** reading, writing, ordering, or [counting L] (M1.2.1) **[5] N-2** identifying place value positions from <u>tenths to millions</u> (M1.2.2)	**The student demonstrates conceptual understanding** • **of <u>fractions (proper or mixed numbers), decimals, percents (whole number), or integers</u> by** **[6] N-1** reading, writing, ordering, or [counting L] (M1.2.1) **[6] N-2** [identifying place value positions <u>from thousandths to millions L</u>] (M1.2.2)

The number in brackets indicates the grade level.

Differences between grade levels are underlined.

The coding at the end of each PSGLE indicates the performance standard the

Some PSGLEs have been identified as Local. They are for local assessment and will not be on a state assessment.

Grade Level Expectations are written for assessment purposes. The PSGLEs should be written in a way so that it is clear what is expected of classroom instruction and/or state assessment.

Criteria for PSGLEs

1. The set of PSGLEs for each grade level should be reasonable to learn within a school year and still allow for learning additional state and local expectations.
2. PSGLEs should promote coherent, focused, developmentally appropriate instructions, as opposed to isolated instruction just on topics, facts, or individual skills.
3. Concepts, skills, and knowledge should be differentiated between adjacent grade levels.
4. PSGLEs should be of similar levels of specificity.
5. PSGLEs should show a continuum of learning. Success in one grade should be a good predictor of success the next year.

Note: Items differentiated with an "i.e." indicate that statewide assessment items may only be written to the content contained within the statement in the parentheses. Items differentiated with an "e.g." do not limit assessment items to that content, but indicate examples of content that may be used in statewide assessment items.

Math Performance Standards are organized into 10 content strands and are coded as follows:
N=Numeration
MEA=Measurement
E&C=Estimation and Computation
F&R=Functions and Relationships
G=Geometry
S&P=Statistics and Probability
PS=Process Skills (The Process Skills include Problem-Solving, Communication, Reasoning, and Connections.)

NOTE: All the PSGLEs for Process Skills are for local assessment. Process Skills that would be assessed on a state assessment have been embedded in PSGLEs for other content strands. For instance, a grade level expectation for the Statistics and Probability content strand for eighth grade is, “[Designing, collecting L], organizing, displaying, or explaining the classification of data in real-world problems.” That Grade Level Expectation for Statistics and Probability incorporates one of the Grade Level Expectations for Process Skills, “representing mathematical problems numerically, graphically, and/or symbolically.”

Math Performance Standards
(Grade Level Expectations)

Content Standard A: Mathematical facts, concepts, principles, and theories
Numeration: Understand and use numeration
Measurement: Select and use systems, units, and tools of measurement

Numeration Performance Standards that apply to grades 7-8: M1.3.1 Read, write, model, and order real numbers, explaining scientific notation, exponents, and percents. **M1.3.2** Model counting in a different base system. **M1.3.3** Translate between equivalent representations of the same number. Select a representation that is appropriate for the situation. **M1.3.4** Describe and model the relationship of fractions to decimals, percents, ratios, and proportions. **M1.3.5** Use, explain, and define the rules of divisibility, prime and composite numbers, multiples, and order of operations. **M1.3.6** Use commutative, identity, associative, and distributive properties with variables.
Measurement Performance Standards that apply to grades 7-8: M2.3.1 Estimate and measure various dimensions to a specified degree of accuracy. **M2.3.2** Estimate and convert measurements within the same system. **M2.3.3** Use a variety of methods and tools to construct and compare plane figures. **M2.3.4** Describe and apply the relationships between dimensions of geometric figures to solve problems using indirect measurement; describe and apply the concepts of rate and scale. **M2.3.5** Apply information about time zones and elapsed time to solve problems.

Grade 8

Understanding Numbers	Understanding Meaning of Operations	Number Theory	Measurable Attributes
The student demonstrates understanding • **of real numbers by** **[8] N-1** ordering real numbers (M1.3.1) **[8] N-2** distinguishing between a whole number in scientific notation and real numbers in standard form (M1.3.1) **[8] N-3** converting between expanded notation (multiples of ten with exponents) and standard form (M1.3.3) • **of rational numbers (fractions, decimals, or percents including integers) by** **[8] N-4** identifying, describing, or illustrating equivalent representations (M1.3.4 & M3.3.5) **[8] N-5** expressing products of numbers using exponents (M1.3.1 & M1.3.3)	**The student demonstrates conceptual understanding of mathematical operations by** **[8] N-6** using models, explanations, number lines, real-life situations, describing or illustrating the effects of arithmetic operations on rational numbers (percents) (M1.2.3) **[8] N-7** using models, explanations, number lines, real-life situations, describing or illustrating the use of inverse operations (addition/subtraction or multiplication/division) (M1.2.3)	**The student demonstrates conceptual understanding of number theory by** **[8] N-8** applying the rules for order of operations to rational numbers (M1.3.5) **[8] N-9** identifying or writing the prime factorization of a number using exponents (M1.3.5) **[8] N-10** [using distributive property with real numbers L] (M1.3.6)	**The student demonstrates understanding of measurable attributes by** **[8] MEA-1** converting measurements within the same system (English or metric) (M2.3.2)

Math Performance Standards
(Grade Level Expectations)

Content Standard A: Mathematical facts, concepts, principles, and theories
Measurement: Select and use systems, units, and tools of measurement
Estimation and Computation: Perform basic arithmetic functions, make reasoned estimates, and select and use appropriate methods or tools
Functions and Relationships: Represent, analyze, and use patterns, relations, and function

Measurement Performance Standards that apply to grades 7-8: M2.3.1 Estimate and measure various dimensions to a specified degree of accuracy. **M2.3.2** Estimate and convert measurements within the same system. **M2.3.3** Use a variety of methods and tools to construct and compare plane figures. **M2.3.4** Describe and apply the relationships between dimensions of geometric figures to solve problems using indirect measurement; describe and apply the concepts of rate and scale. **M2.3.5** Apply information about time zones and elapsed time to solve problems.
Estimation and Computation Performance Standards that apply to grades 7-8: M3.3.1 Apply, explain, and assess the appropriateness of a variety of estimation strategies including truncating and rounding to compatible numbers. **M3.3.2** Apply basic operations efficiently and accurately, using estimation to check the reasonableness of results. **M3.3.3** Add and subtract fractions, decimals, and percents. **M3.3.4** Multiply and divide rational numbers in various forms including fractions, decimals, and percents. **M3.3.5** Convert between equivalent fractions, decimals, percents, and proportions. Convert from exact to decimal representations of irrational numbers. **M3.3.6** Solve problems using ratios and proportions.
Functions and Relationships Performance Standards that apply to grades 7-8: M4.3.1 Identify numeric and geometric patterns to find the next term and predict the nth term. **M4.3.2** Identify and describe how a change in one variable in a function affects the remaining variables (e.g., how changing the length affects the area and volume of a rectangular prism). **M4.3.3** Use a calculator to find a missing item in arithmetic and a geometric sequence; predict the graph of each function. **M4.3.4** Translate among and use tables of ordered pairs, graphs on coordinate planes, and linear equations as tools to represent and analyze patterns. **M4.3.5** Find the value of a variable by evaluating formulas and algebraic expressions for given values.

Grade 8

Measurement Techniques	Estimation	Computation	Describing Patterns and Functions
The student uses measurement techniques by **[8] MEA-2** using scale drawings involving indirect measurement (determining the scale factor and applying it to find missing dimension) (M2.3.4) **[8] MEA-3** [modeling the conversion within the same system L] (M2.3.2)	**The student solves problems (including real-world situations) using estimation by** **[8] E&C-1** [applying and assessing the appropriateness of a variety of estimation strategies L] (M3.3.1)	**The student accurately solves problems (including real-world situations) involving** **[8] E&C-2** adding, subtracting, multiplying or dividing integers or positive rational numbers (M3.3.3 & M3.3.4) **[8] E&C-3** percents and percentages (e.g., tax, discount) (M3.3.3 & M3.3.4) **[8] E&C-4** converting between equivalent fractions, decimals, or percents (M3.3.5) **[8] E&C-5** ratio and proportion (M3.3.6)	**The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by** **[8] F&R-1** describing or extending patterns (linear), up to the nth term, represented in, tables, sequences, graphs, or in problem situations (M4.3.1) **[8] F&R-2** generalizing relationships (linear) using a table of ordered pairs, a graph, or an equation (M4.3.4) **[8] F&R-3** describing in words how a change in one variable in a formula affects the remaining variables (how changing the length affects the area of quadrilaterals or volume of a rectangular prism) (M4.3.2) **[8] F&R-4** [using a calculator as a tool when describing, extending, or representing patterns L] (M4.3.3)

Math Performance Standards
(Grade Level Expectations)

Content Standard A: Mathematical facts, concepts, principles, and theories
Functions and Relationships: Represent, analyze, and use patterns, relations, and function
Geometry: Construct, transform, and analyze geometric figures.

Functions and Relationships Performance Standards that apply to grades 7-8: M4.3.1 Identify numeric and geometric patterns to find the next term and predict the nth term. **M4.3.2** Identify and describe how a change in one variable in a function affects the remaining variables (e.g., how changing the length affects the area and volume of a rectangular prism). **M4.3.3** Use a calculator to find a missing item in arithmetic and a geometric sequence; predict the graph of each function. **M4.3.4** Translate among and use tables of ordered pairs, graphs on coordinate planes, and linear equations as tools to represent and analyze patterns. **M4.3.5** Find the value of a variable by evaluating formulas and algebraic expressions for given values.
Geometry Performance Standards that apply to grades 7-8: M5.3.1 Identify, classify, compare, and sketch regular and irregular polygons. **M5.3.2** Model, identify, draw, and describe 3-dimensional figures including tetrahedrons, dodecahedrons, triangular prisms, and rectangular prisms. **M5.3.3** Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes. **M5.3.4** Estimate and determine volume and surface areas of solid figures using manipulatives and formulas; estimate and find circumferences and areas of circles. **M5.3.5** Draw and describe the results of transformations including translations (slides), rotations (turns), reflections (flips), and dilations (shrinking or enlarging). **M5.3.6** Use coordinate geometry to represent and interpret relationships defined by equations and formulas including distance and midpoint. **M5.3.7** Draw, measure, and construct geometric figures including perpendicular bisectors, polygons with given dimensions and angles, circles with given dimensions, perpendicular and parallel lines.

Grade 8

Modeling and Solving Equations and Inequalities	Geometric Relationships	Transformation of Shapes	Perimeter, Area, and Volume
The student demonstrates algebraic thinking by **[8] F&R-5** translating a written phrase to an algebraic expression (M4.3.5) **[8] F&R-6** solving or identifying solutions to two-step linear equations of the form $ax \pm b = c$, where a, b and c are rational numbers, and $a \neq 0$, translating a story problem into an equation of similar form, or translating a story problem into an equation of similar form and solving it (M4.3.5)	**The student demonstrates an understanding of geometric relationships by** **[8] G-1** [using the attributes and properties of regular polygons to sketch regular or irregular polygons L] (M5.3.1) **[8] G-2** using the attributes and properties of solid figures (vertices, length and alignment of edges, shape and number of bases) to identify and describe cylinders and cones (M5.3.2) **[8] G-3** using two-dimensional nets to create three-dimensional objects (prisms and cylinders) (M5.3.2)	**The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by** **[8] G-4** using proportionality to solve real-world problems involving similar shapes (e.g., two real-world objects casting shadows) (M5.3.3) **[8] G-5** identifying the results of applying transformations (translations, rotations, reflections, dilations) to figures on a coordinate plane (M5.3.5)	**The student solves problems (including real-world situations) by** **[8] G-6** determining the volume of right triangular prisms or cylinders (M5.3.4) **[8] G-7** determining the surface area of cylinders or triangular prisms (M5.3.4) **[8] G-8** determining the circumference and area of a circle (M5.3.4)

Math Performance Standards
(Grade Level Expectations)

Content Standard A: Mathematical facts, concepts, principles, and theories
Geometry: Construct, transform, and analyze geometric figures
Statistics and Probability: Formulate questions, gather and interpret data, and make predictions

Geometry Performance Standards that apply to grades 7-8: M5.3.1 Identify, classify, compare, and sketch regular and irregular polygons. **M5.3.2** Model, identify, draw, and describe 3-dimensional figures including tetrahedrons, dodecahedrons, triangular prisms, and rectangular prisms. **M5.3.3** Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes. **M5.3.4** Estimate and determine volume and surface areas of solid figures using manipulatives and formulas; estimate and find circumferences and areas of circles. **M5.3.5** Draw and describe the results of transformations including translations (slides), rotations (turns), reflections (flips), and dilations (shrinking or enlarging). **M5.3.6** Use coordinate geometry to represent and interpret relationships defined by equations and formulas including distance and midpoint. **M5.3.7** Draw, measure, and construct geometric figures including perpendicular bisectors, polygons with given dimensions and angles, circles with given dimensions, perpendicular and parallel lines.
Statistics and Probability Performance Standards that apply to grades 7-8: M6.3.1 Collect, analyze, and display data in a variety of visual displays including frequency distributions, circle graphs, box and whisker plots, stem and leaf plots, histograms, and scatter plots with and without technology. **M6.3.2** Interpret and analyze information found in newspapers, magazines, and graphical displays. **M6.3.3** Determine and justify a choice of mean, median, or mode as the best representation of data for a practical situation. **M6.3.4** Make projections based on available data and evaluate whether or not inferences can be made given the parameters of the data. **M6.3.5** Use tree diagrams and sample spaces to make predictions about independent events. **M6.3.6** Design and conduct a simulation to study a problem and communicate the results.

Grade 8

Position and Direction

The student demonstrates understanding of position and direction by

[8] G-9 graphing or identifying relationships of variables on a coordinate plane (e.g., length/width, area/diameter, cost/pound) (M5.3.6)

Construction

The student demonstrates a conceptual understanding of geometric drawings or constructions by

[8] G-10 [drawing, measuring, or constructing geometric figures (polygons, perpendicular bisectors, or perpendicular or parallel lines) L] (M5.3.7)

Data Display

The student demonstrates an ability to classify and organize data by

[8] S&P-1 [designing, collecting **L**], organizing, displaying, or explaining the classification of data in real-world problems (e.g., science or humanities, peers or community), using histograms, scatter plots, or box and whisker plots with appropriate scale [or with technology L] (M6.3.1)

Analysis and Central Tendency

The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, or describing trends; or drawing, formulating, or justifying conclusions) by

[8] S&P-2 using information from a variety of displays or analyzing the validity of statistical conclusions found in the media (M6.3.2)

[8] S&P-3 determining or justifying a choice of range, mean, median, or mode as the best representation of data for a practical situation (M6.3.3)

Probability

The student demonstrates a conceptual understanding of probability and counting techniques by

[8] S&P-4 determining or comparing the experimental and/or theoretical probability of simple events (M6.3.5)

[8] S&P-5 using a systematic approach to finding sample spaces or to making predictions about the probability of independent events and using the information to solve real-world problems (M6.3.5)

[8] S&P-6 [designing and conducting a simulation to study a problem and communicate the results L] (M6.3.6)

Math Performance Standards
(Grade Level Expectations)

Content Standards B, C, D, and E: Process skills and abilities
Applying conceptual knowledge and skills designated in all strands of Content Standard A by problem solving, communicating, reasoning, and making connections

Problem-Solving Performance Standards that apply to grades 7-8: M7.3.1 Analyze and summarize a problem using the relationships between the known facts and unknown information. **M7.3.2** Select, modify, and apply a variety of problem-solving strategies including graphing, inductive and deductive reasoning, Venn diagrams, and spreadsheets. **M7.3.3** Evaluate, interpret, and justify solutions to problems.
Communication Performance Standards that apply to grades 7-8: M8.3.1 Use math vocabulary, symbols, and notation to represent information in the problem. **M8.3.2** Represent a problem numerically, graphically, and symbolically; translate among these alternative representations. **M8.3.3** Use appropriate vocabulary, symbols, and technology to explain, justify, and defend mathematical solutions.
Reasoning Performance Standards that apply to grades 7-8: M9.3.1 Use informal deductive and inductive reasoning in both concrete and abstract contexts. **M9.3.2** State counterexamples to disprove statements. **M9.3.3** Justify and defend the validity of mathematical strategies and solutions using examples and counterexamples.
Connections Performance Standards that apply to grades 7-8: M10.3.1 Apply mathematical skills and processes to science and humanities. **M10.3.2** Apply mathematical skills and processes to situations with peers and community.

Grade 8

Problem solving: Understand and be able to select and use a variety of problem-solving strategies	**Communication:** Form and use appropriate methods to define and explain mathematical relationships	**Reasoning:** Use logic and reason to solve mathematical problems	**Connections:** Apply mathematical concepts and processes to situations within and outside of school
The student demonstrates an ability to problem solve by **[8] PS-1** selecting, modifying, and applying a variety of problem-solving strategies (e.g., inductive and deductive reasoning, Venn diagrams, making a simpler problem) and verifying the results (M7.3.2) **[8] PS-2** evaluating, interpreting, and justifying solutions to problems (M7.3.3)	**The student communicates his or her mathematical thinking by** **[8] PS-3** representing mathematical problems numerically, graphically, and/or symbolically, translating among these alternative representations; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions (M8.3.1, M8.3.2, & M8.3.3)	**The student demonstrates an ability to use logic and reason by** **[8] PS-4** generalizing from patterns of observations (inductive reasoning) about mathematical problems and testing using a logical verification (deductive reasoning); or justifying and defending the validity of mathematical strategies and solutions using examples and counterexamples (M9.3.1, M9.3.2, & M9.3.3)	**The student understands and applies mathematical skills and processes across the content strands by** **[8] PS-5** using real-world contexts such as science, humanities, peers, community, and careers (M10.3.1 & M10.4.2)