Grade 8 Mathematics Standards

Comparison Tool for Standards Transition

Updated June 2012

This document can be used to assist educators in analyzing the commonalities and differences between the new Alaska mathematics standards and the Fourth Edition (Grade Level Expectations). This document is a first start toward a transition and districts may choose to augment with more detail.

The first column contains the new math standards. The second column shows the Grade Level Expectations (GLEs) that align to the new standards. The third column provides comments, usually highlighting differences between the new standards and GLEs that align in higher grades. Additionally, the comments may include a notation about an increase in rigor. Rigor may be defined as a standard that requires deeper understanding, higher-order thinking, expanded analytical processes, or simply a skill introduced at an earlier grade.

Note that some GLEs are coded with an L. This signifies that the GLE was not assessed on the statewide assessment; it was to be assessed at the local level. No new standards are identified as being for local assessment. Students advancing through the grades are expected to meet each year’s grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.

In most cases there are not complete matches between the two sets of standards, and it should not be assumed that either the content or skills found in one set of standards will match completely with those of the other set.

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| 6.RP.2. Understand the concept of a unit rate (*a*/*b* associated with a ratio *a:b* with *b ≠* 0, and use rate language in the context of a ratio relationship) and apply it to solve real world problems (e.g., unit pricing, constant speed).  *For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar.” “We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger.”* | **[6] E&C-5** developing and interpreting scale models  Any aligned GLE found in the higher grades will need to be absorbed in the lower grade as part of the transition. | Grade 6 GLE provides a specific real-world model for understanding unit rate.  **[7] E&C-6** solving proportions using a given scale  **[8] E&C-5** using ratio and proportion |

The new standards represent a shift in the purpose of the standards. They are more instructional in nature, intended to guide classroom curriculum. The new standards do not serve as an assessment document, unlike the GLEs. The Department with the support of stakeholders will prepare an assessment framework that will guide the development of the new assessments. The new standards will be assessed starting spring 2016. Until then, all districts will continue administering the Standards Based Assessments aligned to the GLEs through spring 2015.

A table at the end shows the GLEs not matched to the new standards. The comment column indicates where the GLE may be matched to a new standard in a lower or higher grade. Although some GLEs will be taught at other grade levels, teachers must provide opportunities for these GLEs to be reviewed in preparation for the spring Standards Based Assessments through spring 2015.

| **Grade 6 Math GLEs not matched by new standards** | **Comments** |
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| **The student demonstrates conceptual understanding of fractions (proper or mixed numbers), decimals, percents (whole number), or integers by**  **[6] N-2** identifying place value positions from thousandths to millions (L) | Grade 4 and 5 Standards  **(4.NF.6, 4.NF.7, 5.NBT.3)** |

This GLE must be reviewed prior to the SBA through spring 2015.

Finally, the new standards for each grade level define what students should understand and be able to do by the end of each grade which includes the Standards for Mathematical Practice. The Standards for Mathematical Practice describe characteristics and traits that mathematics educators at all levels should seek to develop in their students. They describe ways that students should be engaging with mathematics as they progress through school. The integration of these standards into classroom instruction is a key strategy for increasing cognitive demand and conceptual learning. The Standards for Mathematical Practice are included at the end of the document.

The next page provides an overview of this grade level.

**Grade 8 Overview**

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| **The Number System (NS)**   * Know that there are numbers that are not rational, and approximate them by rational numbers.   **Expressions and Equations (EE)**   * Work with radicals and integer exponents. * Understand the connections between proportional relationships, lines, and linear equations. * Analyze and solve linear equations and pairs of simultaneous linear equations.   **Functions (F)**   * Define, evaluate, and compare functions. * Use functions to model relationships between quantities.   **Geometry (G)**   * Understand congruence and similarity using physical models, transparencies, or geometry software. * Understand and apply the Pythagorean Theorem. * Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.   **Statistics and Probability (SP)**   * Investigate patterns of association in bivariate data. | **In Grade 8, instructional time should focus on four critical areas:**   1. formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; 2. grasping the concept of a function and using functions to describe quantitative relationships; and 3. analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. |
| **Mathematical Practices (MP)**   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning |

**The Number System - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Know that there are numbers that are not rational, and approximate them by rational numbers.** |  |  |
| 8.NS.1. Classify real numbers as either rational (the ratio of two integers, a terminating decimal number, or a repeating decimal number) or irrational. | NEW – not addressed in the GLEs | The student demonstrates understanding  **of real numbers by**  **[10] N-1** identifying their subsets (natural, whole, integers, rational, irrational) |
| 8.NS.2. Order real numbers, using approximations of irrational numbers, locating them on a number line. *For example, show that* √*2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* | **The student demonstrates understanding**  • **of real numbers by**  **[8] N-1** ordering real numbers | The new standard specifies using approximations of irrational numbers. |
| 8.NS.3.Identify or write the prime factorization of a number using exponents. (L) | **[8] N-9** identifying or writing the prime factorization of a number using exponents |  |

**Expressions and Equations - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Work with radicals and integer exponents.** |  |  |
| 8.EE.1. Apply the properties (product, quotient, power, zero, negative exponents, and rational exponents) of integer exponents to generate equivalent numerical expressions. *For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.* | **[8] N-5** expressing products of numbers using exponents | Negative exponents are addressed in the Grade 10 GLE.  **[10] N-2** simplifying expressions with positive and negative exponents |
| 8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form *x*2 = *p* and *x*3 = *p*, where *p* is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. | NEW – not addressed in the GLEs | **[9] N-4** using models, explanations, number lines, real-life situations, describing or illustrating the use of inverse operations (squaring/square root)  **[10] N-3** expressing square roots in simplest radical form  **[10] N-5** describing or illustrating the use of inverse operations(cubing/cube root)  Note the mention of √2 as an irrational number in the new standard. |
| 8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.* | **[8] N-2** distinguishing between a whole number in scientific notation and real numbers in standard form  **[8] N-3** converting between expanded notation (multiples of ten with exponents) and standard form | The new standard requires comparison of the numbers. The GLEs simply require conversion of the numbers. |

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| 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both standard notation and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology. | **[8] N-2** distinguishing between a whole number in scientific notation and real numbers in standard form  **[8] N-3** converting between expanded notation (multiples of ten with exponents) and standard form | The new standard involves operations, which are addressed in the Grade 9 GLE.  **[9] E&C-5** multiplying or dividing numbers in scientific notation (L)  Note the technology reference, which requires recognition of output of E or EE and use of ^. |
| **Understand the connections between proportional relationships, lines, and linear equations.** |  |  |
| 8.EE.5. Graph linearequations such as  *y = mx + b*, interpreting *m* as the slope or rate of change of the graph and *b* as the *y*-intercept or starting value. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* | **The student demonstrates understanding of position and direction by**  **[8] G-9** graphing or identifyingrelationships of variables on a coordinateplane (e.g., length/width, area/diameter, cost/pound)  **The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real world situations by**  **[8] F&R-2** generalizing relationships(linear) using a table of ordered pairs, a graph, or an equation | The new standard requires comparison of two different proportional relationships presented in two different ways.  **[9] G-5** graphing or identifying (using equations or formulas to determine the slope of line segments on a coordinate plane) |
| 8.EE.6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at *b*. | NEW – not addressed in the GLEs |  |

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| **Analyze and solve linear equations and pairs of simultaneous linear equations.** |  |  |
| 8.EE.7. Solve linear equations in one variable.  a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x* = *a*, *a* = *a*, or *a* = *b* results (where *a* and *b* are different numbers).  b. Solve linear equations with rational coefficients, including equations whose solutions require expanding expressions using the distributive property and combining like terms. | a. and b. **[8] F&R-6** solving or identifying solutions to two-step linear equations of the form *ax* + *b* = *c*, where *a*, *b* and *c* are rational numbers and *a* ≠ 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 | a. The new standard requires identifying the number of solutions after simplification.  b. The new standard specifies using the distributive property with variables, which is addressed in the Grade 9 GLE.  **[9] N-6** [using distributive property with variables L] |
| 8.EE.8. Analyze and solve systems of linear equations.  a. Show that the solution to a system of two linear equations in two variables is the intersection of the graphs of those equations because points of intersection satisfy both equations simultaneously.  b. Solve systems of two linear equations in two variables and estimate solutions by graphing the equations. Simple cases may be done by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because  3x + 2y cannot simultaneously be 5 and 6.*  c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.* | NEW – not addressed in the GLEs | a. and b. **[9] F&R-5** modeling (graphically or algebraically) or solving situations (including real-world applications) using systems of linear equations  b. and c. **The student demonstrates understanding of position and direction when solving problems (including real-world situations) by**  **[10] G-7** graphing a system of equations on a coordinate grid, identifying a solution, or determining their relationship (intersecting, parallel, perpendicular) |

**Geometry - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Understand congruence and similarity using physical models, transparencies, or geometry software.** |  |  |
| 8.G.1. Through experimentation, verify the properties of rotations, reflections, and translations (transformations) to figures on a coordinate plane).  a. Lines are taken to lines, and line segments to line segments of the same length.  b. Angles are taken to angles of the same measure.  c. Parallel lines are taken to parallel lines. | a., b., and c.**[8] G-5** identifying the results of applying transformations to figures on a coordinate plane | The new standard specifically addresses lines, line segments, angles and parallel line. |
| 8.G.2. Demonstrate understanding of congruence by applying a sequence of translations, reflections, and rotations on two-dimensional figures. Given two congruent figures, describe a sequence that exhibits the congruence between them. | **The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by**  **[8] G-5** identifying the results of applying transformations to figures on a coordinate plane | The new standard requires describing a sequence to demonstrate congruence; GLEs do not test congruence in the same manner.  **[9] G-2** using a coordinate plane to solve problems involving congruent or similar shapes |
| 8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. | **The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by**  **[8] G-5** identifying the results of applying transformations (translations, rotations, reflections, dilations) to figures on a coordinate plane | The new standard requires describing the effect, which is addressed in the Grade 9 GLE.  **The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by**  **[9] G-3** drawing or describing the results of applying transformations (translations, rotations, reflections, or dilations) to figures on a coordinate plane (L) |
| 8.G.4. Demonstrate understanding of similarity, by applying a sequence of translations, reflections, rotations, and dilations on two-dimensional figures. Describe a sequence that exhibits the similarity between them. | **The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by**  **[8] G-5** identifying the results of applying transformations (translations, rotations, reflections, dilations) to figures on a coordinate plane | The new standard is similar to 8.G.2 except it addresses similarity instead of congruence. |
| 8.G.5. Justify using informal arguments to establish facts about   * the angle sum of triangles (sum of the interior angles of a triangle is 180°) * measures of exterior angles of triangles, * angles created when parallel lines are cut be a transversal (e.g., alternate interior angles) and * angle-angle criterion for similarity of triangles. | NEW – not addressed in the GLEs | The new standard involves using facts that are referenced in the Grade 10 GLE.  **[10] G-1** identifying, analyzing, comparing, or using properties of plane figures:   * supplementary, complementary or vertical angles * angles created by parallel lines with a transversal * sum of interior or exterior angles of a polygon * central angles, chords, inscribed angles or arcs of a circle |
| **Understand and apply the Pythagorean Theorem.** |  |  |
| 8.G.6. Explain the Pythagorean Theorem and its converse. | NEW – not addressed in the GLEs | The new standard requires explaining the theorem and its converse. Grade 9 GLE below references Pythagorean Theorem use.  The student demonstrates understanding of measurement techniques by  **[9] MEA-2** applying indirect methods, such as the Pythagorean Theorem to find missing dimensions, in real-world applications |
| 8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. | NEW – not addressed in the GLEs | The student demonstrates understanding of measurement techniques by  **[9] MEA-2** applying indirect methods, such as the Pythagorean Theorem to find missing dimensions, in real-world applications |
| 8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. | NEW – not addressed in the GLEs | The student demonstrates understanding of measurement techniques by  **[9] MEA-2** applying indirect methods, such as the Pythagorean Theorem to find missing dimensions, in real-world applications |
| **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** |  |  |
| 8.G.9. Identify and apply the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. | **[8] G-6** determining the volume of right triangular prisms or cylinders | The new standard includes volume of cones and spheres. These are in the Grades 9 and 10 GLEs.  **[9] G-4** determining the volume or surface area of prisms, cylinders, cones or pyramids  **[10] G-5** determining the volume or surface area of spheres or compound solids |

**Statistics and Probability - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Investigate patterns of association in bivariate data.** |  |  |
| 8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. | **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]  **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 | The new standard requires describing patterns of association, which is implied in the Grade 9 GLE involving two sets of data.  **[9] S&P-1** [designing, collecting L], organizing, displaying, or explaining the classification of data in real-world problems (e.g., science or humanities, peers, community, or careers) using information from tables or graphs that display two sets of data [or with technology L] |
| 8.SP.2. Explain why straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. | NEW – not addressed in the GLEs | **The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, or, describing trends; or drawing, formulating, or justifying conclusions) by**  **[9] S&P-4** identifying and/or showing the meaning of a best fit line |

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| 8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and *y*-intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* | **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]  **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 | The new standard includes the context interpretation of slope and *y*-intercept from a line of best fit. These are found in Grades 9 and 10 GLEs.  **The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, or, describing trends; or drawing, formulating, or justifying conclusions) by**  **[9] S&P-4** identifying and/or showing the meaning of a best fit line  **The student demonstrates an ability to analyze data *(*comparing, explaining, interpreting, evaluating, making predictions, or describing trends; or drawing, formulating, or justifying conclusions) by**  **[10] S&P-4** using a best fit line to describe trends and make predictions about data |
| 8.SP.4. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects and use relative frequencies to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* | NEW – not addressed in the GLEs |  |

**Functions - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Define, evaluate, and compare functions.** |  |  |
| 8.F.1. Understand that a function is a rule that assigns to each input (the domain) exactly one output (the range). The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. For example, use the vertical line test to determine functions and non-functions. | NEW – not addressed in the GLEs | The new standard includes the definition and terminology of a function and the GLEs do not contain this level of detail.  Function notation not required in Grade 8. |
| 8.F.2. Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* | **[8] F&R-1** describing or extending patterns (linear) up to the *n*th term, representing in tables, sequences, graphs or in problem situations.  **[8] F&R-2** generalizing relationships (linear) using a table or ordered pairs, a graph or an equation. | The new standard requires comparison of two functions in different representations. |
| 8.F.3. Interpret the equation *y* = *mx* + *b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* | NEW – not addressed in the GLEs | The new standards require examples of non-linear functions, which are not addressed in the Grade 8 GLEs.  **[9] F&R-1** describing or extending patterns (families of functions: linear, quadratic, absolute value,), up to the *n*th term, represented in tables, sequences, graphs, or in problem situations |

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| **Use functions to model relationships between quantities.** |  |  |
| 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x*, *y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. | **[8] F&R-2** generalizing relationships (linear) using a table or ordered pairs, a graph or an equation. | The new standard involves interpretation of the rate of change and initial value. |
| 8.F.5. Given a verbal description between two quantities, sketch a graph. Conversely, given a graph, describe a possible real-world example. *For example, graph the position of an accelerating car or tossing a ball in the air.* | **[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) | The new standard specifically requires the translation between verbal/written and graphical representations. |

| **Grade 8 Math GLEs not matched by the new standards** | **Comments** |
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| **The student demonstrates understanding**   * **of rational numbers (fractions, decimals, or percents including integers) by**   **[8] N-4** identifying, describing, or illustrating equivalent representations |  |
| **The student demonstrates conceptual understanding of mathematical operations by**  **[8] N-6** [using models, explanations, number lines, real-life situations, L] describing or illustrating the effects of arithmetic operations on rational numbers (percents) |  |
| **[8] N-7** using models, explanations, number lines, real-life situations, describing, or illustrating the use of inverse operations (addition/subtraction or multiplication/division) |  |
| **The student demonstrates conceptual understanding of number theory by**  **[8] N-8** applying the rules for order of operations to rational numbers | New Grade 5 and 6 Standards **(5.OA.1, 6.EE.2)** |
| **The student demonstrates conceptual understanding of number theory by**  **[8] N-10** [using distributive property with real numbers (L) | New Grade 6 Standard **(6.EE.3)** |
| **The student demonstrates understanding of measurable attributes by**  **[8] MEA-1** converting measurements within the same system (English or metric) |  |
| The student demonstrates understanding of measurement techniques by  **[8] MEA-2** using scale drawings involving indirect measurement (determining the scale factor and applying it to find missing dimension) |  |
| **[8] MEA-3** [modeling the conversion within the same system L] |  |
| 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) |  |
| **The student accurately solves problems (including real-world situations) by**  **[8] E&C-2** adding, subtracting, multiplying or dividing integers or positive rational numbers | New Grade 6 and 7 Standards **(6.NS.2, 6.NS.3, 6.NS.5, 7.NS.1, 7.NS.2, 7.EE.3)** |
| **[8] E&C-3** using percents and percentages (e.g., tax, discount) | New Grade 6 and 7 Standards **(6.RP.3, 7.RP.3, 7.EE.3)** |
| **[8] E&C-4** converting between equivalent fractions, decimals, or percents | New Grade 7 Standard **(7.NS.2)** |
| **[8] E&C-5** using ratio and proportion | New Grade 6 and 7 Standards **(6.RP.1, 6.RP.2, 7.RP.1, 7.RP.2)** |

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| **[8] F&R-4** using a calculator as a tool when describing, extending, or representing patterns (L) |  |
| The student demonstrates algebraic thinking by  **[8] F&R-5** translating a written phrase to an algebraic expression | New Grade 6 Standard **(6.EE.2)** |
| 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) |  |
| **[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 |  |
| **[8] G-3** using two-dimensional nets to create three-dimensional objects (prisms and cylinders) |  |
| 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) |  |
| The student solves problems (including real-world situations) by  [8] G-7 determining the surface area of cylinders or triangular prisms | New Grade 6 Standard **(6.G.4)** |
| The student solves problems (including real-world situations) by  **[8] G-8** determining the circumference and area of a circle | New Grade 7 Standard **(7.G.4)** |
| 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) |  |
| The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, describing trends; drawing, formulating, or justifying conclusions) by  **[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 |  |
| 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 |  |
| **[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 |  |
| **[8] S&P-6** [designing and conducting a simulation to study a problem and communicate the results L] |  |
| **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 | The GLE math process skills are incorporated in to the Standards for Mathematical Practice.   1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.     Descriptions of the Standards for Mathematical Practice follow this chart as well as the grade-span descriptors appropriate to this grade level. |
| **[8] PS-2** evaluating, interpreting, and justifying solutions to problems |
| **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 |
| **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 |
| **The student demonstrates the ability to apply mathematical skills and processes across the content strands by**  **[8] PS-5** using real-world contexts such as science, humanities, peers, community, and careers |

**Alaska New Standards for Mathematical Practice**

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| **1. Make sense of problems and persevere in solving them.**  Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. | **In grades 6‐8 mathematically proficient students will:**   * explain correspondences between a new problem and previous problems * represent algebraic expressions numerically, graphically, concretely/with manipulatives, verbally/written * explain connections between the multiple representations * determine the question that needs to be answered * make a plan for attempting a problem * choose a reasonable strategy * identify the knowns and unknowns in a problem * use previous knowledge and skills to simplify and solve problems * break a problem into manageable parts or simpler problems * solve a problem in more than one way |

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| **2. Reason abstractly and quantitatively.**  Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. | **In grades 6‐8 mathematically proficient students will:**   * represent a situation symbolically and carry out its operations * create a coherent representation of the problem * translate an algebraic problem to a real-world context * explain the relationship between the symbolic abstraction and the context of the problem * compute using different properties * consider the quantitative values, including units, for the numbers in a problem |
| **3. Construct viable arguments and critique the reasoning of others.**  Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. | **In grades 6‐8 mathematically proficient students will:**   * construct arguments using both concrete and abstract explanations * justify conclusions, communicate conclusions, and respond to the arguments * listen to arguments, critique their viability, and ask questions to clarify the argument * compare effectiveness of two arguments by identifying and explaining both logical and/or flawed reasoning * recognize general mathematical truths and use statements to justify the conjectures * identify special cases or counter‐examples that don’t follow the mathematical rules * infer meaning from data and make arguments using its context |

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| **4. Model with mathematics.**  Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two‐way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. | **In grades 6‐8 mathematically proficient students will:**   * apply mathematics to solve problems arising in everyday life and society * identify important quantities in a practical situation and map their relationships using such tools as diagrams, two‐way tables, graphs, and formulas * interpret their mathematical results in the context of the situation and reflect on whether the results make sense * make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised * analyze quantitative relationships to draw conclusions * reflect on whether their results make sense * improve the model if it has not served its purpose |
| **5. Use appropriate tools strategically.**  Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. | **In grades 6‐8 mathematically proficient students will:**   * select and use tools appropriate to the task: pencil and paper, protractor, visual and physical fraction models, algebra tiles, geometric models, calculator, spreadsheet, and interactive geometry software * use estimation and other mathematical knowledge to confirm the accuracy * identify relevant external and digital mathematical resources and use them to pose or solve problems * represent and compare possibilities visually with technology when solving a problem * explore and deepen their understanding of concepts through the use of technological tools |

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| **6. Attend to precision.**  Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. | **In grades 6‐8 mathematically proficient students will:**   * use clear definitions in explanations * understand and use specific symbols accurately and consistently: equality, inequality, ratios, parenthesis for multiplication and division, absolute value, square root * specify units of measure, and label axes to clarify the correspondence with quantities in a problem * calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context |

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| **7. Look for and make use of structure.**  Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression *x*2 + 9*x* + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3*(x* – *y*)2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers *x* and *y*. | **In all grade levels mathematically proficient students will:**   * discern a pattern or structure * understand complex structures as single objects or as being composed of several objects * check if the answer is reasonable |

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| **8. Look for and express regularity in repeated reasoning.**    Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (*y* – 2)/(*x* – 1) = 3. Noticing the regularity in the way terms cancel when expanding (*x* – 1)(*x* + 1), (*x* – 1)(*x*2 + *x* + 1), and  (*x* – 1)(*x*3 + *x*2 + *x* + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. | **In all grade levels mathematically proficient students will:**   * identify if calculations or processes are repeated * use alternative and traditional methods to solve problems * evaluate the reasonableness of their intermediate results, while attending to the details |