Algebra Mathematics Standards

Comparison Tool for Standards Transition

Updated June 2012

This document can be used to assist educators in analyzing the commonalities 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** |
| --- | --- | --- |
| 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.

**The GLEs that are not matched to the new standards can be found in a separate document, HS Math GLEs.** 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 in the separate document, HS Math GLEs.

The next page provides an overview of this conceptual category.

**Algebra Overview**

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| --- | --- |
| **Seeing Structure in Expressions**  • Interpret the structure of expressions.  • Write expressions in equivalent forms to solve problems.  **Arithmetic with Polynomials and Rational Expressions**  • Perform arithmetic operations on polynomials.  • Understand the relationship between zeros and factors of polynomials.  • Use polynomial identities to solve problems.  • Rewrite rational expressions.  **Creating Equations and Inequalities**  • Create equations that describe numbers or relationships.  **Reasoning with Equations and Inequalities**  • Understand solving equations as a process of reasoning and explain the reasoning.  • Solve equations and inequalities in one variable.  • Solve systems of equations.  • Represent and solve equations and inequalities graphically.  **Connections to Functions and Modeling:** Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling. | **In High School, students:**   * Analyze and explain the process of solving an equation, develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems, and master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations; * Explore systems of equations and inequalities to find and interpret their solutions; * Strengthen their ability to see structure in and create quadratic and exponential expressions, create and solve equations, inequalities, and systems of equations involving quadratic expressions; and * Connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. |
| **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. |

**Seeing Structure in Expressions - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
| --- | --- | --- |
| **Seeing Structure in Expressions A-SSE** |  |  |
| **Interpret the structure of expressions** |  |  |
| A-SSE.1. Interpret expressions that represent a quantity in terms of its context.\*  a. Interpret parts of an expression, such as terms, factors, and coefficients.  b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P*(1+*r*)n *as the product of P and a factor not depending on P.* | a.and b. NEW – not addressed in the GLEs |  |
| A-SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see x*4 – *y*4 *as* (*x*2)2 – (*y*2)2, *thus recognizing it as a difference of squares that can be factored as* (*x*2 – *y*2)(*x*2 + *y*2). | **[9] N-2** equating different equivalent representations of the same exponential expression (e.g., 23•25=28) | The GLE only includes exponential expressions. |

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| **Write expressions in equivalent forms to solve problems** |  |  |
| A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*  a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example, x2 + 4x +3 = (x +3)(x +1)*.  b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. *For example, x2 + 4x+3 = (x+2)2 -1.*  c. Use the properties of exponents to transform expressions for exponential functions. *For example the* expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* | a. and b. NEW – not addressed in the GLEs  c. **[9] N-2** equating different equivalent representations of the same exponential expression  **[10] N-2** simplifying expressions with positive and negative exponents | a. GLEs addressselecting and using the quadratic formula to solve problems (**[10] F&R-6)** but not factoring to solve problems.  b. GLEs addressselecting and using the quadratic formula to solve problems (**[10] F&R-6)** but not completing the square to solve problems.  c. The example in the proposed standard indicates more rigor than the GLE does. |
| A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.\** | NEW – not addressed in the GLEs | The concept of series not addressed by the GLEs. |

**Arithmetic with Polynomials and Rational Expressions - Alaska New Mathematics Standards**

| **New Math Standards** | | **Grade Level Expectations** | **Comment** |
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| **Perform arithmetic operations on polynomials** |  |  |
| A –APR.1. Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication. | NEW – not addressed in the GLEs | GLEs do not reference polynomials or closure property. |
| **Understand the relationship between zeros and factors of polynomials** |  |  |
| A –APR.2. Know and apply the Remainder Theorem: For a polynomial *p*(*x*) and a number *a*, the remainder on division by *x* – *a* is *p*(*a*), so *p*(*a*) = 0 if and only if (*x* – *a*) is a factor of *p*(*x*). | NEW – not addressed in the GLEs |  |
| A –APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. | NEW – not addressed in the GLEs |  |
| **Use polynomial identities to solve problems** |  |  |
| A –APR.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* (*x*2 + *y*2)2 = (*x*2 – *y*2)2 + (2*xy*)2 *can be used to generate Pythagorean triples.* | NEW – not addressed in the GLEs |  |
| A –APR.5. (+) Know and apply the Binomial Theorem for the expansion of (*x* + *y*)n in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal’s Triangle. | NEW – not addressed in the GLEs |  |
| **Rewrite rational expressions** |  |  |
| A –APR.6. Rewrite simple rational expressions in different forms; write *a*(*x*)/*b*(*x*) in the form *q*(*x*) + *r*(*x*)/*b*(*x*), where *a*(*x*), *b*(*x*), *q*(*x*), and *r*(*x*) are polynomials with the degree of *r*(*x*) less than the degree of *b*(*x*), using inspection, long division, or, for the more complicated examples, a computer algebra system. | NEW – not addressed in the GLEs |  |
| A –APR.7. (+) Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression. | NEW – not addressed in the GLEs |  |

**Creating Equations and Inequalities - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Create equations and inequalities that describe numbers or relationships** |  |  |
| A –CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* | **[9] F&R-6** solving or identifying solutions to multi-step linear equations of the form  *ax* ± *b* = *cx* ± *d*, where *a, b, c* and *d* are rational numbers and *a* ≠ 0, *c* ≠ 0  **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications)  **[10] F&R-6** selecting and using the quadratic formula to solve problems | **[9] F&R-6 & [10] F&R-6** deal with linear and quadratic equations but do not include rational and exponential functions, or inequalities.  **[10]F&R-5** implies knowledge of solving linear inequalities. |
| A –CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) |  |
| A –CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.* | **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) | Constraints are not specifically mentioned in **[10] F&R-5**, but it is assumed that constraints are addressed when solving real world problems. |
| A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law *V* = *IR* to highlight resistance *R.* | **[10] F&R-7** solving or identifying solutions to literal equations or formulas for a variable involving multi-steps (e.g., solve for h when ) |  |

**Reasoning with Equations and Inequalities - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Understand solving equations as a process of reasoning and explain the reasoning** |  |  |
| A –REI.1. Apply properties of mathematics to justify steps in solving equations in one variable. | **The student demonstrates algebraic thinking by**  **[9] F&R-6** solving or identifying solutions to multi-step linear equations of the form  *ax* ± *b* = *cx* ± *d*, where *a, b, c* and *d* are rational numbers and *a* ≠ 0, *c* ≠ 0 | **[9] F&R-6** assumes that students are justifying their reasoning, not just guessing and checking, to find a solution. |
| A –REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | NEW – not addressed in the GLEs |  |
| **Solve equations and inequalities in one variable** |  |  |
| A –REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | **[9] F&R-6** solving or identifying solutions to multi-step linear equations of the form  *ax* ± *b* = *cx* ± *d*, where *a, b, c* and *d* are rational numbers and *a* ≠ 0, *c* ≠ 0  **[9] F&R-7** solving literal equations or formulas for a variable involving one step (e.g., solve for *t* when *d*=*rt*)  [10] F&R-7 solving or identifying solutions to literal equations or formulas for a variable involving multi-steps (e.g., solve for h when ) |  |

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| A –REI.4. Solve quadratic equations in one variable.  a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form (*x* – *p*)2 = q that has the same solutions. Derive the quadratic formula from this form.  b. Solve quadratic equations by inspection (e.g., for *x*2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as *a* ± *bi* for real numbers *a* and *b*. | a. NEW – not addressed in the GLEs  b. **[10] F&R-6** selecting and using the quadratic formula to solve problems | b. In most cases students are learning to complete the square and factor but it is not stated explicitly in the GLEs. Complex numbers are not addressed in our GLEs. |
| **Solve systems of equations** |  |  |
| A –REI.5. Show that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. | NEW – not addressed in the GLEs |  |
| A –REI.6. Solve systems of linear equations exactly and approximately, e.g., with graphs or algebraically, focusing on pairs of linear equations in two variables. | **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) |  |
| A –REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line y* = –*3x* and the circle *x*2 + *y*2 = *3.* | NEW – not addressed in the GLEs |  |
| A –REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable. | NEW – not addressed in the GLEs |  |
| A –REI.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). | NEW – not addressed in the GLEs |  |
| **Represent and solve equations and inequalities graphically** |  |  |
| A –REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). | **[9] F&R-2** generalizing relationships (linear, quadratic, absolute value) using a table of ordered pairs, a graph, or an equation |  |
| A –REI.11. Explain why the *x*-coordinates of the points where the graphs of the equations *y* = *f*(*x*) and *y* = *g*(*x*) intersect are the solutions of the equation *f*(*x*) = *g*(*x*); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\* | **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) | GLEs address linear equations. Functions, including polynomial, rational, absolute value, exponential, and logarithmic, are not addressed in the GLEs. Function notation is not addressed in the GLEs. |
| A –REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. | **[10] F&R-5** modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) |  |