Statistics and Probability 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 modelsAny 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.

**Statistics and Probability Overview**

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| **Interpreting Categorical and Quantitative Data*** Summarize, represent, and interpret data on a single count or measurement variable.
* Summarize, represent, and interpret data on two categorical and quantitative variables.
* Interpret linear models.

**Making Inferences and Justifying Conclusions*** Understand and evaluate random processes underlying statistical experiments.
* Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

**Conditional Probability and the Rules of Probability*** Understand independence and conditional probability and use them to interpret data.
* Use the rules of probability to compute probabilities of compound events in a uniform probability model.

**Using Probability to Make Decisions*** Calculate expected values and use them to solve problems.
* Use probability to evaluate outcomes of decisions.

**Connections to Functions and Modeling:** Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.  | **In High School, students encounter:*** more formal means of assessing how a model fits data including using regression technique and make judgments about the appropriateness of linear models;
* the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability;
* geometric probability models and use probability to make informed decisions; and
* different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.
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| **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.
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**Interpreting Categorical and Quantitative Data - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Summarize, represent, and interpret data on a single count or measurement variable** |  |  |
| S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots). | **[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]  | Histograms and box plots are specifically referenced in grade 8.**[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] |
| S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. | **[10] 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 or more sets of data [or with technology L] **[10] S&P-3** using and justifying range and measures of central tendency to determine the best representation of the data for a practical situation | GLEs do not reference interquartile range and standard deviation. |
| S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). *For example: Justify why median price of homes or income is used instead of the mean.* | **[10] S&P-3** using and justifying range and measures of central tendency to determine the best representation of the data for a practical situation | Differences in shape and spread are not addressed in the GLEs. The GLE implies that outliers are considered when using measures of central tendency to determine the best representation of data. |
| S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. | NEW – not addressed in the GLEs  |  |
| **Summarize, represent, and interpret data on two categorical and quantitative variables** |  |  |
| S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. | NEW – not addressed in the GLEs  |  |
| S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*b. Informally assess the fit of a function by plotting and analyzing residuals. *For example: Describe solutions to problems that require interpolation and extrapolation.*c. Fit a linear function for a scatter plot that suggests a linear association. | a., b., & c. **[10] S&P-4** using a best fit line to describe trends and make predictions about data | a. GLEs only look at linear functions. When determining the BEST linear model of the data, we use technology.b. The GLE does not require assessing the fit of a function by plotting and analyzing residuals. |

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| **Interpret linear models** |  |  |
| S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. | **[10] S&P-4** using a best fit line to describe trends and make predictions about data | The GLEdoes not explicitly state slope or intercept but it is implied that both are used to describe trends and make predictions about the data. |
| S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. | NEW – not addressed in the GLEs |  |
| S-ID.9. Distinguish between correlation and causation. | NEW – not addressed in the GLEs |  |

**Making Inferences and Justifying Conclusions - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Understand and evaluate random processes underlying statistical experiments** |  |  |
| S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. | NEW – not addressed in the GLEs | The GLEs do not address samples and populations specifically, **[10] S&P-6** does address theoretical and experimental probability.**[10] S&P-6** analyzing data to make predictions about the probability of independent or dependent events as a basis for solving real-world problems |
| S-IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* | **[10] S&P-2** using information from a display to solve a problem or analyzing the validity of statistical conclusions**[10] S&P-6** analyzing data to make predictions about the probability of independent or dependent events as a basis for solving real-world problems |  |
| **Make inferences and justify conclusions from sample surveys, experiments, and observational studies** |  |  |
| S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. | NEW – not addressed in the GLEs |  |

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| S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. | NEW – not addressed in the GLEs |  |
| S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. | NEW – not addressed in the GLEs |  |
| S-IC.6. Evaluate reports based on data. | **[10] S&P-2** using information from a display to solve a problem or analyzing the validity of statistical conclusions |  |

**Conditional Probability and the Rules of Probability - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Understand independence and conditional probability and use them to interpret data** |  |  |
| S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). | **[9] PS-1** selecting, modifying, and applying a variety of problem-solving strategies (e.g., charts, graphing, inductive and deductive reasoning, Venn diagrams) and verifying the results |  |
| S-CP.2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. | **[10] S&P-5** explaining in words or identifying the difference between experimental and theoretical probability of independent or dependent events  |  |
| S-CP.3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. | NEW – not addressed in the GLEs |  |

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| S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in 10th grade. Do the same for other subjects and compare the results.* | NEW – not addressed in the GLEs |  |
| S-CP.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* | **[10] S&P-5** explaining in words or identifying the difference between experimental and theoretical probability of independent or dependent events  |  |
| **Use the rules of probability to compute probabilities of compound events in a uniform probability model** |  |  |
| S-CP.6. Find the conditional probability of *A* given *B* as the fraction of *B*’s outcomes that also belong to *A,* and interpret the answer in terms of the model. | NEW – not addressed in the GLEs |  |
| S-CP.7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. | NEW – not addressed in the GLEs |  |

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| S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. | NEW – not addressed in the GLEs |  |
| S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. | NEW – not addressed in the GLEs |  |

**Using Probability to Make Decisions - Alaska New Mathematics Standards**

| **New Math Standards** | **Grade Level Expectations** | **Comment** |
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| **Calculate expected values and use them to solve problems** |  |  |
| S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. | NEW – not addressed in the GLEs |  |
| S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. | NEW – not addressed in the GLEs |  |
| S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* | NEW – not addressed in the GLEs |  |
| S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* | NEW – not addressed in the GLEs |  |
| **Use probability to evaluate outcomes of decisions** |  |  |
| S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* | NEW – not addressed in the GLEs |  |
| S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). | **[6] S&P-4** [analyzing whether a game is mathematically fair or unfair by explaining the probability of all possible outcomes L] |  |
| S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). | **[10] S&P-6** analyzing data to make predictions about the probability of independent or dependent events as a basis for solving real-world problems |  |