DATA ANALYSIS & PROBABILITY (DP)

Kindergarten		Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Grade 7		Grade 8		Grades 9-12	
MA.1.DP.1 Develop an understanding for collecting, representing and comparing data.	MA.K.DP.1.1 Collect and sort objects into categories and compare the categories by counting the objects in each category. Report the results verbally, with a written numeral or with drawings.	**MA.1.DP.1** Collect, represent and interpret data using pictographs and tally marks.	MA.1.DP.1.1 Collect data into categories and represent the results using tally marks or pictographs. MA.1.DP.1.2 Interpret data represented with tally marks or pictographs by calculating the total number of data points and comparing the totals of different categories.	**MA.2.DP.1** Collect, categorize, represent and interpret data using appropriate titles, labels and units.	MA.2.DP.1.1 Collect, categorize and represent data using tally marks, tables, pictographs or bar graphs. Use appropriate titles, labels and units. MA.2.DP.1.2 Interpret data represented with tally marks, tables, pictographs or bar graphs including solving addition and subtraction problems.	**MA.3.DP.1** Collect, represent and interpret numerical and categorical data.	MA.3.DP.1.1 Collect and represent numerical and categorical data with whole-number values using tables, scaled pictographs, scaled bar graphs or line plots. Use appropriate titles, labels and units. MA.3.DP.1.2 Interpret data with whole-number values represented with tables, scaled pictographs, circle graphs, scaled bar graphs or line plots by solving one- and two-step problems.	**MA.4.DP.1** Collect, represent and interpret data and find the mode, median and range of a data set.	MA.4.DP.1.1 Collect and represent numerical data, including fractional values, using tables, stem-and-leaf plots or line plots. MA.4.DP.1.2 Determine the mode, median or range to interpret numerical data including fractional values, represented with tables, stem-and-leaf plots or line plots. MA.4.DP.1.3 Solve real-world problems involving numerical data.	**MA.5.DP.1** Collect, represent and interpret data and find the mean, mode, median or range of a data set.	MA.5.DP.1.1 Collect and represent numerical data, including fractional and decimal values, using tables, line graphs or line plots. MA.5.DP.1.2 Interpret numerical data, with whole-number values, represented with tables or line plots by determining the mean, mode, median or range.	**MA.6.DP.1** Develop an understanding of statistics and determine measures of center and measures of variability. Summarize statistical distributions graphically and numerically.	MA.6.DP.1.1 Recognize and formulate a statistical question that would generate numerical data. MA.6.DP.1.2 Given a numerical data set within a real-world context, find and interpret mean, median, mode and range. MA.6.DP.1.3 Given a box plot within a real-world context, determine the minimum, the lower quartile, the median, the upper quartile and the maximum. Use this summary of the data to describe the spread and distribution of the data. MA.6.DP.1.4 Given a histogram or line plot within a real-world context, qualitatively describe and interpret the spread and distribution of the data, including any symmetry, skewness, gaps, clusters, outliers and the range. MA.6.DP.1.5 Create box plots and histograms to represent sets of numerical data within real-world contexts. MA.6.DP.1.6 Given a real-world scenario, determine and describe how changes in data values impact measures of center and variation.	**MA.7.DP.1** Represent and interpret numerical and categorical data.	MA.7.DP.1.1 Determine an appropriate measure of center or measure of variation to summarize numerical data, represented numerically or graphically, taking into consideration the context and any outliers. MA.7.DP.1.2 Given two numerical or graphical representations of data, use the measure(s) of center and measure(s) of variability to make comparisons, interpret results and draw conclusions about the two populations. MA.7.DP.1.3 Given categorical data from a random sample, use proportional relationships to make predictions about a population. MA.7.DP.1.4 Use proportional reasoning to construct, display and interpret data in circle graphs. MA.7.DP.1.5 Given a real-world numerical or categorical data set, choose and create an appropriate graphical representation.	**MA.8.DP.1** Represent and investigate numerical bivariate data.	MA.8.DP.1.1 Given a set of real-world bivariate numerical data, construct a scatter plot or a line graph as appropriate for the context. MA.8.DP.1.2 Given a scatter plot within a real-world context, describe patterns of association. MA.8.DP.1.3 Given a scatter plot with a linear association, informally fit a straight line.	**MA.912.DP.1** Summarize, represent and interpret categorical and numerical data with one and two variables.	MA.912.DP.1.1 Given a set of data, select an appropriate method to represent the data, depending on whether it is numerical or categorical data and on whether it is univariate or bivariate. MA.912.DP.1.2 Interpret data distributions represented in various ways. State whether the data is numerical or categorical, whether it is univariate or bivariate and interpret the different components and quantities in the display. MA.912.DP.1.3 Explain the difference between correlation and causation in the contexts of both numerical and categorical data. MA.912.DP.1.4 Estimate a population total, mean or percentage using data from a sample survey; develop a margin of error through the use of simulation. MA.912.DP.1.5 Interpret the margin of error of a mean or percentage from a data set. Interpret the confidence level corresponding to the margin of error.

MA.7.DP.2 Develop an understanding of probability. Find and compare experimental and theoretical probabilities.	MA.7.DP.2.1 Determine the sample space for a simple experiment. MA.7.DP.2.2 Given the probability of a chance event, interpret the likelihood of it occurring. Compare the probabilities of chance events. MA.7.DP.2.3 Find the theoretical probability of an event related to a simple experiment. MA.7.DP.2.4 Use a simulation of a simple experiment to find experimental probabilities and compare them to theoretical probabilities.	**MA.8.DP.2** Represent and find probabilities of repeated experiments.	MA.8.DP.2.1 Determine the sample space for a repeated experiment. MA.8.DP.2.2 Find the theoretical probability of an event related to a repeated experiment. MA.8.DP.2.3 Solve real-world problems involving probabilities related to single or repeated experiments, including making predictions based on theoretical probability.	**MA.912.DP.2** Solve problems involving univariate and bivariate numerical data.	MA.912.DP.2.1 For two or more sets of numerical univariate data, calculate and compare the appropriate measures of center and measures of variability, accounting for possible effects of outliers. Interpret any notable features of the shape of the data distribution. MA.912.DP.2.2 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. MA.912.DP.2.3 Estimate population percentages from data that has been fit to the normal distribution. MA.912.DP.2.4 Fit a linear function to bivariate numerical data that suggests a linear association and interpret the slope and y-intercept of the model. Use the model to solve real-world problems in terms of the context of the data. MA.912.DP.2.5 Given a scatter plot that represents bivariate numerical data, assess the fit of a given linear function by plotting and analyzing residuals. MA.912.DP.2.6 Given a scatter plot with a line of fit and residuals, determine the strength and direction of the correlation. Interpret strength and direction within a real-world context. MA.912.DP.2.7 Compute the correlation coefficient of a linear model using technology. Interpret the strength and direction of the correlation coefficient. MA.912.DP.2.8 Fit a quadratic function to bivariate numerical data that suggests a quadratic association and interpret any intercepts or the vertex of the model. Use the model to solve real-world problems in terms of the context of the data. MA.912.DP.2.9 Fit an exponential function to bivariate numerical data that suggests an exponential association. Use the model to solve real-world problems in terms of the context of the data.
				MA.912.DP.3 Solve problems involving categorical data.	MA.912.DP.3.1 Construct a two-way frequency table summarizing bivariate categorical data. Interpret joint and marginal frequencies and determine possible associations in terms of a real-world context. MA.912.DP.3.2 Given marginal and conditional relative frequencies, construct a two-way relative frequency table summarizing categorical bivariate data. MA.912.DP.3.3 Given a two-way relative frequency table or segmented bar graph summarizing categorical bivariate data, interpret joint, marginal and conditional relative frequencies in terms of a real-world context. MA.912.DP.3.4 Given a relative frequency table, construct and interpret a segmented bar graph. MA.912.DP.3.5 Solve real-world problems involving univariate and bivariate categorical data.

	MA.912.DP.4 Use and interpret independence and probability.	MA.912.DP.4.1 Describe events as subsets of a sample space using characteristics, or categories, of the outcomes, or as unions, intersections or complements of other events. MA.912.DP.4.2 Determine if events A and B are independent by calculating the product of their probabilities. MA.912.DP.4.3 Calculate the conditional probability of two events and interpret the result in terms of its context. MA.912.DP.4.4 Interpret the independence of two events using conditional probability. MA.912.DP.4.5 Given a two-way table containing data from a population, interpret the joint and marginal relative frequencies as empirical probabilities and the conditional relative frequencies as empirical conditional probabilities. Use those probabilities to determine whether characteristics in the population are approximately independent. MA.912.DP.4.6 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. MA.912.DP.4.7 Apply the addition rule for probability, taking into consideration whether the events are mutually exclusive, and interpret the result in terms of the model and its context. MA.912.DP.4.8 Apply the general multiplication rule for probability, taking into consideration whether the events are independent, and interpret the result in terms of the context. MA.912.DP.4.9 Apply the addition and multiplication rules for counting to solve mathematical and real-world problems, including problems involving probability. MA.912.DP.4.10 Given a mathematical or real-world situation, calculate the appropriate permutation or combination.

MA.912.DP.5 Determine methods of data collection and make inferences from collected data.	MA.912.DP.5.1 Distinguish between a population parameter and a sample statistic. MA.912.DP.5.2 Explain how random sampling produces data that is representative of a population. MA.912.DP.5.3 Compare and contrast sampling methods. MA.912.DP.5.4 Generate multiple samples or simulated samples of the same size to measure the variation in estimates or predictions. MA.912.DP.5.5 Determine if a specific model is consistent within a given process by analyzing the data distribution from a data-generating process. MA.912.DP.5.6 Determine the appropriate design, survey, experiment or observational study, based on the purpose. Articulate the types of questions appropriate for each type of design. MA.912.DP.5.7 Compare and contrast surveys, experiments and observational studies. MA.912.DP.5.8 Draw inferences about two populations using data and statistical analysis from two random samples. MA.912.DP.5.9 Compare two treatments using data from an experiment in which the treatments are assigned randomly. MA.912.DP.5.10 Determine whether differences between parameters are significant using simulations. MA.912.DP.5.11 Evaluate reports based on data from diverse media, print and digital resources by interpreting graphs and tables; evaluating data-based arguments; determining whether a valid sampling method was used; or interpreting provided statistics.

	MA.912.DP.6 Use probability distributions to solve problems.	MA.912.DP.6.1 Define a random variable for a quantity of interest by assigning a numerical value to each individual outcome in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. MA.912.DP.6.2 Develop a probability distribution for a discrete random variable using theoretical probabilities. Find the expected value and interpret it as the mean of the discrete distribution. MA.912.DP.6.3 Develop a probability distribution for a discrete random variable using empirical probabilities. Find the expected value and interpret it as the mean of the discrete distribution. MA.912.DP.6.4 Given a binomial distribution, calculate and interpret the expected value. Solve real-world problems involving binomial distributions. MA.912.DP.6.5 Solve real-world problems involving geometric distributions. MA.912.DP.6.6 Solve real-world problems involving Poisson distributions. MA.912.DP.6.7 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values and standard deviations. Evaluate and compare strategies on the basis of the calculated expected values and standard deviations. MA.912.DP.6.8 Apply probabilities to make fair decisions, such as drawing from lots or using a random number generator