Standard 6: Statistics

	6	Pre-Algebra Plus	Algebra	Geometry	Algebra II	Fourth Course	12
Benchmark 1 (Part 1)	Develop understanding of statistical variability.				Summarize, represent, and interpret data on a single count or measurement variable.		
	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.				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.		
	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.						
	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.						
Benchmark 1 (Part 2)	Summarize and describe distributions.		Summarize, represent, and interpret data on a single count or measurement variable.				
	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.		Represent data with plots on the real number line.				
	Summarize numerical data sets in relation to their context, such as by:		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.				

			Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).				
Benchmark 1 (Part 3)			Investigate patterns of association in bivariate data.				
			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.				
			Know that 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.				
			Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.				
			Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.				

Benchmark 1 (Part 4)			Summarize, represent, and interpret data on two categorical and quantitative variables. (Linear focus; discuss general principle)				
			Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data. Recognize possible associations and trends in the data				
			Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.				
Benchmark 1 (Part 5)			Interpret linear models.				
			Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.				
			Compute (using technology) and interpret the correlation coefficient of a linear fit.				
			Distinguish between correlation and causation.				
Benchmark 2 (Part 1)		Use random sampling to draw inferences about a population.			Understand and evaluate random processes underlying statistical experiments.		
		Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.			Understand statistics as a process for making inferences about population parameters based on a random sample from that population.		

		Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.			Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.		
Benchmark 2 (Part 2)		Draw informal comparative inferences about two populations.			Make inferences and justify conclusions from sample surveys, experiments and observational studies.		
		Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.			Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.		
		Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.			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.		
					Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.		
					Evaluate reports based on data.		
Benchmark 3 (Part 1)		Investigate chance processes and develop, use, and evaluate probability models.		Use the rules of probability to compute probabilities of compound events in a uniform probability model			

		Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.		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.			
		Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.		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.			
		Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.		(+) 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.			
		Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.		(+) Use permutations and combinations to compute probabilities of compound events and solve problems.			
Benchmark 3 (Part 2)				Understand independence and conditional probability and use them to interpret data.(Link to data from simulations or experiments)			
				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").			

				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.			
				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.			
				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.			
				Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.			
Benchmark 4 (Part 1)				Use probability to evaluate outcomes of decisions. Introductory; apply counting rules	Use probability to evaluate outcomes of decisions. Include more complex situations	Use probability to evaluate outcomes of decisions.	
				(+) Use probabilities to make fair decisions.	(+) Use probabilities to make fair decisions.	Weigh the possible outcomes of decisions by assigning probabilities to payoff values and finding expected values.	
				(+) Analyze decisions and strategies using probability concepts.	(+) Analyze decisions and strategies using probability concepts.		
Benchmark 4 (Part 2)						Calculate expected values and use them to solve problems.	

						(+) 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.	
						(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	
						(+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	
						(+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.	