

Probability and Statistics

The following standards outline the content of a one-year course in Probability and Statistics. If a one-semester course is desired, the standards with an asterisk (*) would apply. Students enrolled in this course are assumed to have mastered the concepts identified in the Standards of Learning for Algebra II. The purpose of the course is to present basic concepts and techniques for collecting and analyzing data, drawing conclusions, and making predictions.

A graphing calculator is essential for every student taking the Probability and Statistics course and is required for the Advanced Placement Statistics Examination. The calculator may not fully substitute for a computer, however. In the absence of a computer for student use, teachers may provide students with examples of computer output generated by a statistical software package.

- *PS.1 The student will analyze graphical displays of data, including dotplots, stemplots, and histograms, to identify and describe patterns and departures from patterns, using central tendency, spread, clusters, gaps, and outliers. Appropriate technology will be used to create graphical displays.
- *PS.2 The student will analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using mean, median, mode, variance, standard deviation, interquartile range, range, and outliers. Appropriate technology will be used to calculate statistics.
- *PS.3 The student will compare distributions of two or more univariate data sets, analyzing center and spread (within group and between group variations), clusters and gaps, shapes, outliers, or other unusual features. Appropriate technology will be used to generate graphical displays.
- *PS.4 The student will analyze scatterplots to identify and describe the relationship between two variables, using shape; strength of relationship; clusters; positive, negative, or no association; outliers; and influential points. Appropriate technology will be used to generate scatterplots and identify outliers and influential points.
- PS.5 The student will find and interpret linear correlation, use the method of least squares regression to model the linear relationship between two variables, and use the residual plots to assess linearity. Appropriate technology will be used to compute correlation coefficients and residual plots.
- PS.6 The student will make logarithmic and power transformations to achieve linearity. Appropriate technology will be used.
- PS.7 The student, using two-way tables, will analyze categorical data to describe patterns and departure from patterns and to find marginal frequency and relative frequencies, including conditional frequencies.

- *PS.8 The student will describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting.
- *PS.9 The student will plan and conduct a survey. The plan will address sampling techniques (e.g., simple random and stratified) and methods to reduce bias.
- PS.10 The student will plan and conduct an experiment. The plan will address control, randomization, and measurement of experimental error.
- *PS.11 The student will compute and distinguish between permutations and combinations and use technology for applications.
- *PS.12 The student will identify and describe two or more events as complementary, dependent, independent, and/or mutually exclusive.
- *PS.13 The student will find probabilities (relative frequency and theoretical), including conditional probabilities for events that are either dependent or independent, by applying the “law of large numbers” concept, the addition rule, and the multiplication rule.
- *PS.14 The student will develop, interpret, and apply the binomial probability distribution for discrete random variables, including computing the mean and standard deviation for the binomial variable.
- PS.15 The student will simulate probability distributions, including binomial and geometric.
- PS.16 The student will identify random variables as independent or dependent and find the mean and standard deviations for sums and differences of independent random variables.
- *PS.17 The student will identify properties of a normal distribution and apply the normal distribution to determine probabilities, using a table or graphing calculator.
- *PS.18 The student, given data from a large sample, will find and interpret point estimates and confidence intervals for parameters. The parameters will include proportion and mean, difference between two proportions, and difference between two means (independent and paired).
- PS.19 The student will apply and interpret the logic of a hypothesis-testing procedure. Tests will include large sample test for proportion, mean, difference between two proportions, and difference between two means (independent and paired) and Chi-squared test for goodness of fit, homogeneity of proportions, and independence.

- PS.20 The student will identify the meaning of sampling distribution with reference to random variable, sampling statistic, and parameter and explain the Central Limit Theorem. This will include sampling distribution of a sample proportion, a sample mean, a difference between two sample proportions, and a difference between two sample means.
- PS.21 The student will identify properties of a t-distribution and apply t-distributions to single-sample and two-sample (independent and matched pairs) t-procedures, using tables or graphing calculators.