

Advanced Placement Probability and Statistics Chapter

of the

Mathematics Framework

*for California Public Schools:
Kindergarten Through Grade Twelve*

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Advanced Placement Probability and Statistics*

When taught in high school, Advanced Placement Probability and Statistics should be presented with the same level of depth and rigor as are entry-level college and university statistics and probability courses. The content standards presented in this chapter are technical and in-depth extensions of probability and statistics. In particular, mastery of academic content for advanced placement gives students the background to succeed in the Advanced Placement examination for this subject. Consideration of the College Board syllabi for the Statistics and Probability sections of the Advanced Placement Examination in Mathematics may be helpful in making curricular decisions.†

The sample problems in this chapter are meant to illustrate and clarify the content standards. Some problems are written in a form that can be used directly with students; others will need to be modified before they are used with students.

*This chapter is taken from the 2005 *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (CDE 2006). The standards presented in the chapter were first adopted in 1997 and were unchanged in the 2010 adoption of the California Common Core State Standards for Mathematics.

†Advanced Placement (AP) course descriptions are updated regularly. Please visit AP Central (<http://apcentral.collegeboard.com/>) to determine whether a more recent course description is available.

- 1.0 Students solve probability problems with finite sample spaces by using the rules for addition, multiplication, and complementation for probability distributions and understand the simplifications that arise with independent events.
- 2.0 Students know the definition of *conditional probability* and use it to solve for probabilities in finite sample spaces.

Sample Problem:

You have 5 coins in your pocket: 1 penny, 2 nickels, 1 dime, and 1 quarter. If you pull out 2 coins at random and they are collectively worth more than 10 cents, what is the probability that you pulled out a quarter?

- 3.0 Students demonstrate an understanding of the notion of *discrete random variables* by using this concept to solve for the probabilities of outcomes, such as the probability of the occurrence of five or fewer heads in 14 coin tosses.
- 4.0 Students understand the notion of a *continuous random variable* and can interpret the probability of an outcome as the area of a region under the graph of the probability density function associated with the random variable.

Sample Problem:

Consider a continuous random variable x whose possible values are numbers between 0 and 2 and whose probability density function is given by $f(x) = 1 - \frac{1}{2}x$ for $0 \leq x \leq 2$.
What is the probability that $x > 1$?

- 5.0 Students know the definition of the *mean of a discrete random variable* and can determine the mean for a particular discrete random variable.
- 6.0 Students know the definition of the *variance of a discrete random variable* and can determine the variance for a particular discrete random variable.
- 7.0 Students demonstrate an understanding of the standard distributions (normal, binomial, and exponential) and can use the distributions to solve for events in problems in which the distribution belongs to those families.

Sample Problem:

Suppose that X is a normally distributed random variable with mean $m = 0$.
If $P(X < c) = \frac{2}{3}$, find $P(-c < X < c)$.

- 8.0 Students determine the mean and the standard deviation of a normally distributed random variable.
- 9.0 Students know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially.

- 10.0 Students know the definitions of the *mean*, *median*, and *mode* of distribution of data and can compute each of them in particular situations.
- 11.0 Students compute the variance and the standard deviation of a distribution of data.
- 12.0 Students find the line of best fit to a given distribution of data by using least squares regression.
- 13.0 Students know what the *correlation coefficient of two variables* means and are familiar with the coefficient's properties.
- 14.0 Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line graphs and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.
- 15.0 Students are familiar with the notions of a statistic of a distribution of values, of the sampling distribution of a statistic, and of the variability of a statistic.
- 16.0 Students know basic facts concerning the relation between the mean and the standard deviation of a sampling distribution and the mean and the standard deviation of the population distribution.
- 17.0 Students determine confidence intervals for a simple random sample from a normal distribution of data and determine the sample size required for a desired margin of error.
- 18.0 Students determine the *P*-value for a statistic for a simple random sample from a normal distribution.
- 19.0 Students are familiar with the *chi*-square distribution and *chi*-square test and understand their uses.