

Mathematics

Course: Probability and Statistics

12th Grade

MATH 601 Probability and Statistics

1/2 credit

5 days per week (1st Semester)

Taught in English

This is a required class for all 12th grade students in the Mexican and/or U.S. diploma program. In this course students will develop the knowledge and skills necessary to be able to organize, analyze and graph data, as well as make decisions based on the data. Students will also study permutations and combinations, discrete mathematics and probabilities. Students will be able to model problems and solve them.

Textbook: Brase, Charles Henry and Corrinne Pellillo Brase. *Understandable Statistics, Concepts & Methods*, Houghton/Mifflin Company. Boston, MA (2003 Edition)

Prerequisite: MATH 502

Benchmark Code- Subject: Probability and Statistics = PS

Strand 1: Introduction to Statistics

Strand 2: Organizing Data.

Strand 3: Averages and Variation

Strand 4: Elementary Probability Theory.

Strand 5: The Binomial Probability Distribution and Related Topics.

Strand 6: Normal Distributions.

Strand 7: Introduction to Sample Distributions.

Code: Subject.Grade#.Strand#.Standard#. Benchmark#

Example: PS.12.1.4.3 – Probability and Statistics, Twelfth Grade, Strand 1, Standard 4, Benchmark 3

Strand 1: Introduction to Statistics

Standard 1: The student states the importance of the study of statistics, the nature of the statistical data, what a sample is, what the sampling methods are and how to design ways to collect data.

Benchmark Code	Benchmark
PS.12.1.1.1	The student will identify variables in a statistical study.
PS.12.1.1.2	The student will distinguish between quantitative and qualitative variables.
PS.12.1.1.3	The student will identify populations and samples.
PS.12.1.1.4	The student will determine the levels of measurement.
PS.12.1.1.5	The student will compare descriptive and inferential statistics.

Standard 2: The student explains why random sampling is important to the study of statistics. The student uses a calculator or a random number table to make a simulation, and describes different sampling strategies and how to use them.	
Benchmark Code	Benchmark
PS.12.1.2.1	The student will explain the importance of random samples.
PS.12.1.2.2	The student will construct a simple random sample using random numbers.
PS.12.1.2.3	The student will simulate a random process.
PS.12.1.2.4	The student will describe stratified sampling, cluster sampling, systematic sampling and convenience sampling.
Standard 3: The student learns the basics for planning a statistical study, understanding the differences between observations and experiments.	
Benchmark Code	Benchmark
PS.12.1.3.1	The student will explain the term census.
PS.12.1.3.2	The student will describe simulations, observational studies, and experiments.
PS.12.1.3.3	The student will identify control groups, placebo effects, and randomized two-treatment design.
PS.12.1.3.4	The student will discuss potential pitfalls that might make the data unreliable.
Strand: 2 Organize Data	
Standard 1: The student displays information effectively using a variety graphs.	
Benchmark Code	Benchmark
PS.12.2.1.1	The student will determine types of graphs appropriate for specific data.
PS.12.2.1.2	The student will construct bar graphs, Pareto charts, circle graphs, and time plots.
PS.12.2.1.3	The student will interpret information displayed in graphs.
Standard 2: The student organizes data in a frequency table and constructs a histogram or a frequency polygon.	
Benchmark Code	Benchmark
PS.12.2.2.1	The student will organize raw data using a frequency table.
PS.12.2.2.2	The student will construct histograms, relative-frequency histograms, frequency polygons and orgies.
PS.12.2.2.3	The student will recognize basic distribution shapes: uniform, symmetric, bimodal, and skewed.
PS.12.2.2.4	The student will recognize basic distribution shapes: uniform, symmetric, bimodal, and skewed.
PS.12.2.2.5	The student will organize raw data using a frequency table.
Standard 3: The student constructs a stem-and-leaf display.	
Benchmark Code	Benchmark
PS.12.2.3.1	The student will construct a stem-and-leaf display from raw data.

PS.12.2.3.2	The student will use a stem-and-leaf display to visualize data distribution.
PS.12.2.3.3	The student will compare a stem-and leaf display to a histogram.
Strand: 3 Averages and Variation	
Standard 1: The student understands, states, and/or computes the measures of central tendency.	
Benchmark Code	Benchmark
PS.12.3.1.1	The student will compute mean, median and mode of raw data.
PS.12.3.1.2	The student will interpret what mean, mode and median tell us.
PS.12.3.1.3	The student will explain how mean, median and mode can be affected by extreme data values.
PS.12.3.1.4	The student will compute a trimmed means and explains why is used.
Standard 2: The student understands, states, and/or computes the measures of variation.	
Benchmark Code	Benchmark
PS.12.3.2.1	The student will find the range, variance, and standard deviation.
PS.12.3.2.2	The student will compute the coefficient of variation from raw data and understand its importance.
PS.12.3.2.3	The student will apply Chebyshev's theorem to raw data.
PS.12.3.2.4	The student will understand the information given by the Chebyshev's theorem.
Standard 3: The student understands, states and/or computes the mean, variance and standard deviation of grouped data.	
Benchmark Code	Benchmark
PS.12.3.3.1	The student will estimate the mean, variance, and standard deviation from grouped data.
PS.12.3.3.2	The student will compute a weighted average.
PS.12.3.3.3	The student will understand the applications of weighted averages.
Standard 4: The student understands states and/or computes percentiles, the five number summary and constructs a box-and-whiskers plot.	
Benchmark Code	Benchmark
PS.12.3.4.1	The student will interpret the meaning of percentile scores.
PS.12.3.4.2	The student will compute the median, quartiles, and five-number summary from raw data.
PS.12.3.4.3	The student will make a box-and-whisker plot and interpret its results.
PS.12.3.4.4	The student will describe how a box-and-whisker plot indicates spread of data around the median.
Strand: 4 Elementary Probability Theory	
Standard 1: The student understands the methods to assign probabilities and apply them to basic problems.	
Benchmark Code	Benchmark

PS.12.4.1.1	The student will assign probabilities to events. Relative frequency. Law of large numbers. Equally likely outcomes.
PS.12.4.1.2	The student will explain how the law of large numbers relates to relative frequencies.
PS.12.4.1.3	The student will apply basic rules of probability in everyday life. Sample space. Complement of an event.
PS.12.4.1.4	The student will explain the relationship between statistics and probability.
Standard 2: The student understands and applies basic probability rules.	
Benchmark Code	Benchmark
PS.12.4.2.1	The student will compute probabilities of general compound events. What is an independent event? What is a compound event?
PS.12.4.2.2	The student will compute probabilities involving independent events or mutually exclusive events. Multiplication rule. Addition rule.
PS.12.4.2.3	The student will use results to compute conditional probabilities.
Standard 3: The student constructs tree diagrams, organizes the outcomes of a series of event, and assigns probabilities to these outcomes.	
Benchmark Code	Benchmark
PS.12.4.3.1	The student will organize outcomes in a sample space using tree diagrams.
PS.12.4.3.2	The student will compute a number of ordered arrangements of outcomes using permutations.
PS.12.4.3.3	The student will compute a number of (non-ordered) groupings of outcomes using combinations.
PS.12.4.3.4	The student will explain how counting techniques relate to probability in everyday life.
Strand 5: Random Variables and Probability Distributions	
Standard 1: The student learns the difference between continuous and discrete random variables and graphs discrete distributions and computes their parameters.	
Benchmark Code	Benchmark
PS.12.5.1.1	The student will distinguish between continuous and random variables.
PS.12.5.1.2	The student will graph discrete probability distributions.
PS.12.5.1.3	The student will compute the mean μ and standard deviation σ for a discrete probability distribution.
PS.12.5.1.4	The student will compute the mean μ and standard deviation σ for linear function of a random variable x .
PS.12.5.1.5	The student computes the mean μ and standard deviation σ for a linear combination of two independent random variables.
Standard 2: The student learns the characteristics of a binomial probability distribution and the computation of binomial probabilities.	
Benchmark Code	Benchmark

PS.12.5.2.1	The student will list the defining features of a binomial experiment.
PS.12.5.2.2	The student will compute binomial probabilities using the formula for this probability distribution.
PS.12.5.2.3	The student will use a binomial table to find the probability of an event $P(r)$.
PS.12.5.2.4	The student will use the binomial probability distribution to solve real-world situations.
Standard 3: The student graphs binomial distributions and computes their parameters.	
Benchmark Code	Benchmark
PS.12.5.3.1	The student will make histograms for binomial distributions.
PS.12.5.3.2	The student will compute the mean μ and standard deviation σ for a binomial distribution.
PS.12.5.3.3	The student will compute the minimal number of trials n to achieve a given probability of success $P(r)$.
Standard 4: The student learns the characteristics of geometric and poisson probability distributions and the computation of geometric and poisson probabilities.	
Benchmark Code	Benchmark
PS.12.5.4.1	The student will use the geometric probability distribution to compute the probability that the n th trial is the first success.
PS.12.5.4.2	The student will use the Poisson distribution to compute the probability of the occurrence of events spread out over time or space.
PS.12.5.4.3	The student will use the Poisson distribution to approximate the binomial distribution when the number of trials is large and the probability of success is small.
Strand: 6 Normal Distribution	
Standard 1: The student graphs normal distributions and understands its properties.	
Benchmark Code	Benchmark
PS.12.6.1.1	The student will graph a normal curve and summarize its important properties.
PS.12.6.1.2	The student will apply the empirical rule to solve real-life problems.
PS.12.6.1.3	The student will use control limits to construct control charts and examine the chart for out of control.
Standard 2: The student learns to compute z scores and finds the area under the standard normal curve.	
Benchmark Code	Benchmark
PS.12.6.2.1	Given μ and σ , the student will convert raw data to z scores
PS.12.6.2.2	Given μ and σ , the student will convert z scores to raw data.
PS.12.6.2.3	The student will graph the standard normal distribution and find areas under the standard normal curve.
Standard 3: The student learns to compute probabilities of "standardized events" and solves guarantee problems.	

Benchmark Code	Benchmark
PS.12.6.3.1	The student will compute the probability of "standardized events.
PS.12.6.3.2	The student will find a z score from a given normal probability. (inverse normal).
PS.12.6.3.3	Use the inverse normal to solve guarantee problems
Standard 4: Students learns to use the normal approximation of the Binomial distribution	
Benchmark Code	Benchmark
PS.12.6.4.1	The student will state the assumptions needed for the normal approximation to the binomial
PS.12.6.4.2	The student will compute μ and σ for the normal approximation.
PS.12.6.4.3	The student will use the continuity correction to convert a range of r values to a corresponding range of normal x values.
PS.12.6.4.4	The student will convert the x values to a range of standardized z scores and find desired probabilities.