

**K – 12 MATHEMATICS  
UNIFYING STANDARDS**

- 1.0 Number Sense and Operations** – Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.
- 2.0 Patterns, Functions, and Algebra** – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.
- 3.0 Measurement** – Students know and understand attributes, units and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.
- 4.0 Geometry and Spatial Sense** – Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.
- 5.0 Data Analysis, Statistics, and Probability** – Students know how to pose questions and collect, organize, represent and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.
- 6.0 Problem Solving** – Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, while demonstrating an attitude of persistence and reflection in their approaches.
- 7.0 Processes: Reasoning, Communication, and Connections** – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

## FOCUS GOALS STATISTICS

### 1.0 Number Sense and Operations

- 1.1 Demonstrate understanding of a discrete and continuous random variable.
- 1.2 Determine the mean and standard deviation of a normal or binomial distribution.
- 1.3 Perform operations on sampling distribution using the Central Limit Theorem.
- 1.4 Use combinations and permutations to determine the number of ways an event can occur.
- 1.5 Discern when an estimate is reasonable, and when an exact answer is appropriate.

### 2.0 Patterns, Functions, and Algebra

- 2.1 Interpret graphical displays of distributions of univariate data.
- 2.2 Understand properties of the normal distribution and the sampling distribution.
- 2.3 Understand and apply the properties of the binomial distribution.
- 2.4 Use the normal approximation of the binomial distribution.

### 3.0 Measurement

- 3.1 Summarize distributions of univariate data by computing measures of center, spread, and position.
- 3.2 Explain parameter and variability of a statistic.

### 4.0 Geometry and Spatial Sense

- 4.1 Organize and describe distributions of data using dotplots, stemplots, boxplots, frequency tables, histograms, and line graphs.
- 4.2 Compare distributions of univariate data using dotplots, back-to-back stemplots, and parallel boxplots.

### 5.0 Data Analysis, Statistics, and Probability

- 5.1 Explore categorical data with frequency tables and two-way tables.
- 5.2 Compute expected value and variance of a discrete random variable.
- 5.3 Solve probability problems with finite sample spaces using the rules for addition, multiplication, complementation, and independence.
- 5.4 Understand conditional probabilities and use them to solve probability problems.
- 5.5 Understand the concept of the law of large numbers.
- 5.6 Collect data for observational studies.

### 6.0 Problem Solving

- 6.1 Make decisions about how to approach problems.
- 6.2 Plan and conduct a survey using various random sampling techniques.
- 6.3 Understand and identify sources of bias.
- 6.4 Design and conduct simulations of probability distributions.

### 7.0 Processes: Reasoning, Communications, and Connections

- 7.1 Communicate math thinking and conclusions using words, graphs, and charts.
- 7.2 Draw conclusions after organizing and summarizing data.
- 7.3 Give examples of the application of statistics in other disciplines.
- 7.4 Apply literacy skills when making mathematical connections.

## MATH STANDARDS STATISTICS

**1.0 Number Sense and Operations** - Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.

**1.1 Demonstrate understanding of a discrete and continuous random variable.** (c3/p)

- o Explain what is meant by a random variable. (cb)
- o Define and recognize discrete and continuous random variables. (c3/cb)
- o Determine if the measurement level of a variable is nominal, ordinal, interval, or ratio. (cb)

**1.2 Determine the mean and standard deviation of a normal or binomial distribution.** (c5,7)

- o Find the mean and standard deviation of a set of numbers. (c5)
- o Find the mean and standard deviation of a binomial distribution. (c4)
- o Understand what is meant by the unbiased estimator. (cb)

**1.3 Perform operations on sampling distribution using the Central Limit Theorem.** (c/ap1)

- o Understand what is meant by the distribution of the sample means. (cb)
- o Use the Central Limit Theorem to find probabilities. (cb)

**1.4 Use combinations and permutations to determine the number of ways an event can occur.** (c/aII18-19)

- o Explain what is meant by a permutation and a combination. (cb)
- o Count the number of ways “n” objects can be arranged. (cb)
- o Count the number of ways “r” objects can be selected from “n” objects. (cb)
- o Solve combination problems involving “and/or”. (cb)
- o Use Pascal’s Triangle as a model for combinations. (cb/s)

**1.5 Discern when an estimate is reasonable, and when an exact answer is appropriate.** (p)

**2.0 Patterns, Functions, and Algebra** - Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.

**2.1 Interpret graphical displays of distributions of univariate data.** (p)

- o Understand the meaning of an outlier and their effect on measures of center.
- o Describe a distribution skew as positive, negative, or symmetrical.

**2.2 Understand properties of the normal distribution (c4) and the sampling distribution.**

(p)

- o Use the Empirical Rule to interpret the data in a distribution. (cb)
- o Explain why the area under the normal curve is 1. (cb)
- o Explain what is meant by approximately normal. (cb)
- o Describe the importance of the inflection point. (cb)
- o Locate the mean, median, and mode in a skewed distribution. (cb6/s)
- o Determine the center and spread of a standard normal distribution. (cb5)
- o Standardize and unstandardize between raw scores and standard scores. (cb)
- o Find the probability of a given value. (cb)

**2.3 Understand and apply the properties of the binomial distribution. (c4)**

- o Understand the requirements for a binomial distribution. (cb)
- o Apply the binomial probability formula. (cb)
- o Determine the binomial probability of a given value. (cb)
- o Use Pascal's Triangle as a binomial distribution model. (cb)

**2.4 Use the normal approximation of the binomial distribution. (p)**

- o Determine conditions for using the normal approximation.
- o Use continuity correction in probability statements.
- o Find binomial probabilities using the normal distribution.

**4.0 Measurement** - Students know and understand attributes, units, and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.

**3.1 Summarize distributions of univariate data by computing measures of center, spread, and position. (c6)**

- o Find the mean, median, and range of a set of numbers or frequency distribution. (c6/cb)
- o Find the mode of a set of numbers and the modal class of a frequency distribution. (c6/cb)
- o Use z-scores to compare raw scores from different distributions. (cb)
- o Describe the following quantiles: percentile, decile, and quartile. (cb)
- o Find the percentile rank of each value in a set of numbers. (cb)
- o Compute the weighted mean of a frequency distribution. (cb)
- o Know the basic properties and uses of measures of center. (cb)

**3.2 Explain parameter and variability of a statistic. (p/c6)**

- o Know the meaning of descriptive and inferential statistics.
- o Distinguish between a population and a sample.
- o Compare and contrast the terms parameter and statistic.

**4.0 Geometry and Spatial Sense** - Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.

- 4.1 Organize and describe distributions of data using dotplots, stemplots, boxplots, frequency tables, histograms, and line graphs.** (c14/s)
- o Identify qualitative and quantitative variables. (cb)
  - o Determine the boundaries of a number or of a class. (cb)
  - o Know the difference between class limits and class boundaries. (cb)
  - o Define categorical, grouped, and ungrouped classes. (cb)
  - o Determine class width given the required number of classes. (cb)
  - o Determine relative frequency and cumulative frequency. (cb)
  - o Construct a histogram, cumulative frequency graph, relative frequency graph, stem plot, box plot, or compound time-series graph from a given set of data. (cb)
  - o Understand what is meant by interquartile range. (cb)
  - o Determine the 5-number summary of a set of data. (cb)
- 4.2 Compare distributions of univariate data using dotplots, back-to-back stemplots, and parallel boxplots.** (p)
- o Determine when and how to use back-to-back stemplots and split stemplots.
  - o Construct parallel boxplots to interpret data.

**6.0 Data Analysis, Statistics, and Probability** - Students know how to pose questions and collect, organize, represent and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.

- 5.1 Explore categorical data with frequency tables (c8) and two-way tables.** (p)
- o Find the marginal distribution of a two-way table.
  - o Find probabilities using a two-way table.
- 5.2 Compute expected value and variance of a discrete random variable.** (c3)
- o Understand what is meant by the variance of a set of numbers. (cb)
  - o Determine the expected value and variance of a probability distribution. (cb)
  - o Compute the mean and variance of a binomial distribution. (cb)
- 5.3 Solve probability problems with finite sample spaces using the rules for addition, multiplication, complementation, and independence.** (c1/p)
- o Understand the meaning of an event and a compound event. (cb)
  - o Determine the sample space of an experiment. (cb)
  - o Make a tree diagram for a sequence of events and list all possible outcomes. (cb)
  - o Understand equally likely, and mutually exclusive events. (cb)
  - o Define empirical, theoretical, and classical probabilities. (cb)

- o Find the probability of a simple events compound events. (cb)
- o Apply the rules of complement of an event. (cb)
- o Simplify probabilities using at least complements. (cb)
- o Understand the requirements for a probability distribution. (cb)
- o Construct a probability distribution table and graph a probability distribution. (cb)

**5.4 Understand conditional probabilities and use them to solve probability problems. (c2)**

- o Find the conditional probability B given event A has occurred. (cb)
- o Find conditional probabilities when using two-way tables.\*

**5.5 Understand the concept of the law of large numbers. (p)**

- o Define the law of large numbers. (cb)
- o Understand the effects of the law of large numbers. (cb)

**5.6 Collect data for observational studies. (p)**

- o Use sampling techniques to collect data from a given population.
- o Identify by raw data.
- o Collect raw data and organize it into graphical form.

**6.0 Problem Solving** - Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, while demonstrating an attitude of persistence and reflection in their approaches.

**6.1 Make decisions about how to approach problems. (p9-12)**

- o Analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.
- o Identify and utilize appropriate tools.
- o Make generalizations based on prior knowledge and related examples.

**6.2 Plan and conduct a survey using various random sampling techniques. (p)**

- o Explain how sampling saves time and money.
- o Explain the uses of a stratified sample, systematic sample, and a cluster sample.
- o Define sampling error.
- o Recognize examples of convenience sampling and voluntary sampling.
- o Understand why, when, and how to use a random number table.

**6.3 Understand and identify sources of bias. (p)**

- o Define bias in sampling.
- o Understand the bias in a convenience sampling.
- o Define response bias.

**6.4 Design and conduct simulations of probability distributions. (p)**

- o Describe the steps in a probability experiment.
- o Understand the meaning of an experiment and a trial.
- o Simulate a given problem using probabilities.

**7.0 Processes: Reasoning, Communications, and Connections** - Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

**7.1 Communicate math thinking and conclusions using words, graphs, and charts. (p)**

**7.2 Draw conclusions after organizing and summarizing data. (p)**

- o Understand what is meant by statistical inference.
- o Clearly explain processes and properties used to arrive at conclusions.
- o Compare the sample mean to the population mean after sampling.

**7.3 Give examples of the application of statistics in other disciplines. (p)**

- o Provide examples of sampling bias from history or current events.
- o Give examples of the use of statistics in real-world situations.

**7.4 Apply literacy skills when making mathematical connections. (p-language arts)**

- o Learn and use mathematics vocabulary encountered through reading. (R1.0)
- o Use strategies to comprehend, analyze, and evaluate mathematics reading materials. (R2.0)
- o Employ technology to organize and record mathematics information. (R3.0)
- o Write about mathematics to convey ideas logically and correctly. (W2.0)