Unit 4: Probability and Statistics

Content Area: **Mathematics**
Course(s): **College Math I**
Time Period: **March**
Length: **8 weeks**
Status: **Published**

Unit Overview

This unit investigates probabilities, the fundamental counting principal, odds and expectations, gathering and organizing data, and measures of central tendencies.

Transfer

Students will be able to independently use their learning to...

Use the fundamental counting principal, probabilities, gathering and organizing data and measures of central tendencies in real world situations.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- Probability is one of the most useful concepts in math because being able to anticipate the likelihood of events can be useful in many real world situations.
- Generally speaking, probability is simply a number that describes how likely an event is to occur.
- Odds are used in many ways including insurance companies in determining the amount to charge for premiums.
- two events are mutually exclusive if they cannot both occur at the same time.
- Statistics is the branch of mathematics that involves collecting, organizing, summarizing, and presenting data and drawing general conclusions from the data.

- Two events are independent if the fact that A occurs has no effect on the probability of B occuring.

Essential Questions

- How does a permutation of *n* objects differ from a permutation of *n* objects taken *r* at a time?
- What is the difference between a permutation and a combination?
- What is the difference between and outcome and an event?
- What is the biggest advantage of combinations and permutations?
- What is the difference between dependent and independent events?
- How are histograms and frequency polygons similar? How are they different?

Application of Knowledge and Skill

Students will know...

Students will know...

- Probability is one of the most useful concepts in math because being able to anticipate the likelihood of events can be useful in many real world situations.
- Generally speaking, probability is simply a number that describes how likely an event is to occur.
- Odds are used in many ways including insurance companies in determining the amount to charge for premiums.
- two events are mutually exclusive if they cannot both occur at the same time.
- Statistics is the branch of mathematics that involves collecting, organizing, summarizing, and presenting data and drawing general conclusions from the data.
- Two events are independent if the fact that A occurs has no effect on the probability of B occuring.

Students will be skilled at...

Students will be skilled at...

- Using the fundamental counting principal

- finding permutations and combinations
- Computing classical and empiracal probabilities
- Using tree diagrams and tables to find sample spaces and compute probabilities
- Computing probabilities using permutations and combinations
- computing odds in favor/against an outcome.

Academic Vocabulary

permutation	combination	outcome
probability experiment	sample space	event
tree diagram	independent event	dependent event
conditional probability	data	statistics
population	sample	frequency distribution
stem and leaf plot	bar graph	circle graph
histogram	mean	median
mode	range	variance
standard deviation	percentile	quartile

===> LEARNING GOAL 4.1 - Probability

Students apply methods of probability including the Fundamental Counting Principle, Permutations and Combinations, Odds and Expectations

Objective 4.1.1 (Fundamental Counting Principle/Permutations) (level of difficulty: Retrieval)

SWBAT:

(11.1)

- Use the fundamental counting principle
- Calculate the value of factorial expressions
- Solve permutation problems

MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.

Objective 4.1.2 (Combinations) (level of difficulty: Comprehension)

SWBAT:

(11.2)

- Distinguish between combinations and permutations
- Use the combination rule in conjunction with the fundamental counting principle.

MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.

Objective 4.1.3 (Basic Probability) (level of difficulty: Retrieval - executing)

SWBAT:

(11.3)

- Compute classical and empirical probabilities

MA.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
MA.S-MD.A.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

Objective 4.1.4 (Tree Diagrams, Sample Spaces and Tables) (level of difficulty: Comprehension)

SWBAT:

(11.4)

- Use tree diagrams and tables to find sample spaces and compute probabilities

MA.S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MA.S-CP.A.4	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.

Objective 4.1.5 (Probability using Permutations and Combinations) (level of difficulty: Retrieval)

SWBAT:

(11.5)

- Compute probabilities using combinations and permutations

MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.

Objective 4.1.6 (Odds and Expectations) (level of difficulty: Retrieval - executing)

SWBAT:

(11.6)

- Compute odds in favor of and odds against an outcome
- Compute odds from probability
- Compute probability from odds
- Compute expected value

MA.S-CP.B	Use the rules of probability to compute probabilities of compound events in a uniform probability model

Objective 4.1.7 (Computations with Probabilities) (level of difficulty: Retrieval - executing)

SWBAT:

(11.7-8)

- Use the additions rules for probability
- Find the probability of two or more dependent/independent events all occuring
- Find conditional probabilities

MA.S-CP.B.6	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.
MA.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B \mid A)] = [P(B)] \times [P(A \mid B)]$, and interpret the answer in terms of the model.

===> LEARNING GOAL 4.2 - Statistics

Develop the statistical skills needed to describe data sets using graphs and numerical summaries, supply inferential statistical techniques in decision making and demonstrate the ability to apply and explain statistical applications to real life situations.

Objective 4.2.1 (Gather and Organize Data) (level of difficulty: Retrieval to Comprehension)

SWBAT

(12.1)

- Define data and statistics
- Describe four basic methods of sampling
- Construct frequency tables and stem and leaf plots

MA.S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MA.S-IC.B.4	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.
MA.S-CP.A.4	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.

Objective 4.2.2 (Data Graphs) (level of difficulty: Comprehension - symbolizing)

SWBAT

(12.2)

- Draw and interpret various data graphs (bar, circle, histograms...)

MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

Objective 4.2.3 (Measures of Central Tendencies) (level of difficulty: Comprehension to Analysis)

SWBAT

(12.3)

- Compute, compare and analyze mean, median, mode and range

MA.S-ID.A.2	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.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.S-ID.A.4	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.

Summative Assessment

Tests, quizzes, End of Unit Benchmark, Projects

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Formative Assessment and Performance Opportunities

Classroom discussion

class/homework

class closure

class openers

group work

presentations

projects

student teacher discussions

Accommodations and Modifications

504 Accomodations

IEPs

challenge problems

heterogeneous grouping

Problems of the week

projects

small group instruction

technology

Unit Resources

- Textbook: Math in Our World, 2nd Edition (McGraw Hill, 2011)
- Kuta Software
- Examview Software

Additional Websites:

- Dan Meyer's 3-Act Math Tasks: https://docs.google.com/spreadsheet/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=html
- NCTM Illuminations Website: Resources for Teaching Math: http://illuminations.nctm.org/Default.aspx
- PARCC Educator Resources: http://www.parcconline.org/for-educators
- The Geometer's Sketchpad Resource Center: http://www.dynamicgeometry.com/
- Khan Academy: https://www.khanacademy.org/