

05 Data Analysis and Probability

Content Area: **Mathematics**
Course(s):
Time Period: **Week1**
Length: **1 Week**
Status: **Published**

Stage 1: Desired Results

Unit Overview/ Rationale

This unit introduces the topics of data analysis and probability.

Standards & Indicators

Common Core: Mathematics, Common Core: Grade 8 Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

MA.9-12.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.9-12.S-CP.B.8

Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

MA.9-12.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.9-12.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.9-12.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.9-12.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.9-12.S-CP.A.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).
MA.9-12.S-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
MA.9-12.S-CP.A.3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
MA.9-12.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.
MA.9-12.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Big Ideas - Students will understand that...

-Different measures can be used to interpret and compare sets of data.

-When collecting data, it is important for the results to accurately represent the situation.

-Data can be organized in matrices or in intervals. Different measures can be used to interpret and compare sets of data. Separating data into subsets is a useful way to summarize and compare data sets.

-Counting methods can be used to find the number of possible ways to choose objects with and without regard to order.

-The probability of an event, or $P(\text{event})$, tells how likely it is that the event will occur. Probabilities can be found by reasoning mathematically or by using experimental data. The probability of a compound event can sometimes be found from expressions of the probabilities of simpler events.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

-How can collecting and analyzing data help you make decisions or predictions?

-How can you make and interpret different representations of data?

-How is probability related to real-world events?

Content - Students will know...

Key Vocabulary

Combination, event, matrix, measure of central tendency, outcome, outlier, permutation, probability, quartile, sample space

Skills - Students will be able to...

-Find measures of central tendency.

-Examine samples and conduct surveys.

-Make predictions based on the data they collect and observe.

-Organize data in displays such as matrices, frequency tables, histograms, and box-and-whisker plots.

-Describe a data set by using measures of central tendency.

-Compare theoretical and experimental probabilities.

-Find probabilities of simple events and compound events.

Stage 2: Assessment Evidence

Assessment

Stage 3: Learning Plan

Learning Activities

Activities:

Students will find the sum, difference or products of matrices. Students will make histograms. Students will find the mean, median, mode, and range for given data sets.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to find the mean, median, mode, and range for a given data set.

Example:

The quality ratings of 9 movies showing at a movie theater near you are 5.6, 7.9, 7.0, 5.9, 7.8, 6.2, 6.4, 5.2, and 5.6. What are the mean, median, mode, and range for given data?

Sample Solution:

Mean:

$$(5.6 + 7.9 + 7.0 + 5.9 + 7.8 + 6.2 + 6.4 + 5.2 + 5.6) / 9 = 6.4$$

Median: 6.2 (middle value)

Mode: 5.6 (occurs most often)

Range: $7.9 - 5.2 = 2.7$

Activities:

Students will make box-and-whisker plots for data sets. Students will determine which box-and-

whisker plot represents the data set with different interquartile qualities.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to determine which box-and-whisker plot represents the data set with the greater interquartile range?

Example:

Determine which box-and-whisker plot represents the data set with the greater interquartile range? Explain.

Sample Solution:

Given two box-and-whisker plots, students will state the B is the best choice. The box in A is from about 90 to 110, where the box in B is from about 75 to 125.

Activities:

Students will determine whether a sampling method is random, systematic, or stratified and whether it is biased or unbiased.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to determine whether a sampling method is random, systematic, or stratified and whether it is biased or unbiased.

Example:

A survey asks, "Should Plainville make itself proud by building a beautiful new library?" Is the question biased

Sample Solution:

Yes, the question is biased. The words proud and beautiful make it clear that the answer is expected

to be yes.

Activities:

Students will find the number of permutations and combinations given an arrangement of objects.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to find the number of permutations and combinations given an arrangement of objects.

Example:

In how many ways can you choose 3 people to serve on a committee out of a group of 7 volunteers?

Sample Solution:

$${}^7C_3 = \frac{7!}{(3!(7-3)!)}$$

$$= \frac{7!}{(3!4!)}$$

$$= \underline{7}$$

$$= \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(3 \cdot 2 \cdot 1)(4 \cdot 3 \cdot 2 \cdot 1)}$$

$$= \frac{6 \cdot 5 \cdot 4}{3 \cdot 2 \cdot 1}$$

$$= \frac{120}{6} = 20$$

= 35 ways to choose 3 people out of a group of 7.

Activities:

Students will determine the theoretical and experimental probabilities of event occurring.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to will determine the theoretical and experimental probabilities of event occurring.

Example:

What is the theoretical probability that a randomly chosen date is a day beginning with T?

Sample Solution:

There are 2 favorable outcomes, Tuesday and Thursday.

There are 7 possible outcomes, the 7 days of the week.

$P(\text{day beginning with T}) =$

$\frac{\# \text{ of favorable outcomes}}{\# \text{ of possible outcomes}}$

$= \frac{2}{7}$

Activities:

Students will determine probabilities of independent and dependent compound events.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to determine probabilities of independent and dependent compound events.

Example:

You roll a number cube and flip a coin. What is the probability that you roll a 5 and the coin comes up heads?

Sample Solution:

Rolling a 5 and flipping heads are independent events.

$P(5 \text{ and heads}) = P(5)$

• $P(\text{heads})$

$= 1/6$

• $1/2 = 1/12$

Resources

Pearson Algebra 1 c 2012

Chapter 12: Data Analysis and Probability