

## Probability and Statistics Syllabus

### RCAS Policies/Procedures

Students will be required to follow all RCAS policies and procedures. To view the RCAS High School Student Handbook, click [handbook](#).

### Course Description

Students will study the three major topics in Statistics: Descriptive Statistics (including measures of center and spread), Inferential Statistics (analyzing study design and making conclusions about populations from a sample), and Probability (such as games of chance and counting methods). They will also learn to critically evaluate Statistics in their daily lives in order to become more informed consumers and citizens.

### Grading

Points shall be awarded for assignments, projects, quizzes, and tests. Points will be awarded and collected cumulatively throughout the semester.

### Textbook

Transition to College Mathematics and Statistics, McGraw Hill Education, 2016

### Reading

NA

### Optional Reading

NA

### Instructional Resources

KhanAcademy.org

CK12.org

Desmos.com

### Essential Questions

What are the characteristics of a trustworthy study?

How do I calculate and display categorical data about groups of subjects?

How do I compare the likelihood of a certain outcome for two different groups?

How do I determine the accuracy of a diagnostic test?

What inferences can be made about a population based on the results of a sample?

What methods can be used to count the number of outcomes for different scenarios?

How do I calculate the probability of an event or series of events?

## Essential Learning Intentions

### UNIT 1

- Understand terms used to compare risk: absolute risk reduction, relative risk
- Distinguish between explanatory and response variables
- Interpret bar graphs displaying categorical data
- Understand the limitations of anecdotal evidence and the possibility of lurking variables
- Learn the characteristics of a well-designed experiment, especially the role of randomization
- Understand how to design an experiment to account for the placebo effect, including single and double blinding
- Understand what it means for groups to be homogeneous
- Distinguish between a population and a sample
- Compute expected frequencies using marginal totals and proportional reasoning
- Understand that expected frequencies show what homogeneous samples would have looked like
- Compute the chi-square statistic and understand that the more different the two samples, the larger it will be
- Determine if the chi-square statistic is statistically significant and write a conclusion
- Understand the four summary statistics that can be used to describe how well a test performs: sensitivity, specificity, positive predictive value, and negative predictive value
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- Review the concepts of conditional probability and independent events
- Distinguish between situations calling for a chi-square test of homogeneity and a chi-square test of independence
- Compute expected frequencies for a chi-square test of independence using the definition of independent events and then compute the chi-square statistic
- Determine if the chi-square statistic is statistically significant and write a conclusion

### UNIT 3

- Develop the skill of systematic counting by thinking carefully about the number of possibilities in a variety of contexts
- Understand and apply basic counting strategies, such as making tree diagrams, making systematic lists, and using the Multiplication Principle of Counting and the Addition Principle of Counting
- Understand the importance of counting in many situations
- Understand and apply order and repetition in counting problems
- Develop, analyze, apply, and make sense of the formulas for counting permutations and combinations
- Solve counting problems by applying several methods and concepts in any given problem
- Understand, apply, and connect three basic counting problems—counting selections from a collection of objects (the four order and repetition problem types), counting the outcomes from a sequence of tasks (the Multiplication Principle of Counting), and counting the outcomes from a union (the Addition Principle of Counting).
- Understand the importance of counting in many situations
- Apply counting methods to probability situations in which all outcomes are equally likely
- Review and apply the General Multiplication Rule for Probability; in particular, use the Multiplication Principle of Counting, permutations, and combinations
- Understand and apply the Binomial Theorem

- Understand and apply connections among combinations, the Binomial Theorem, and Pascal's triangle
- Develop the skill of combinatorial reasoning, including its use in proofs

#### **UNIT 5**

- Review terminology and rules of probability, including the Addition and Multiplication rules
- Distinguish between random sampling with and without replacement and know when it matters when computing probabilities
- Develop and use the binomial probability formula
- Compute and interpret the expected value of a binomial distribution
- Compute and interpret a P-value for the proportion of successes in a sample
- Decide whether the results from a random sample can reasonably be attributed to chance alone or whether another explanation is needed
- Know the meaning of the terms census, population, parameter, sample survey, sample, and estimate from the sample
- Use random sampling and stratified random sampling
- Distinguish between bias due to method of sampling and sampling error
- Recognize types of bias due to the method used to get the sample
- Recognize types of bias in getting and recording the responses from the sample
- Critically analyze surveys and polls reported in the media
- Distinguish between point and interval estimates of a parameter
- Use an approximate sampling distribution to estimate the probability of getting a sampling error of a given size or less
- Develop a formula for the margin of error for a proportion, and compute and interpret it
- Construct and interpret a 95% confidence interval for a proportion
- Understand the meaning of 95% confidence