

Unit 03: Probability, Random Variables, and Probability Distributions

Content Area:

Course(s):

Time Period: **Year**

Length: **180**

Status: **Published**

Unit 3

Unit Title:	Probability, Random Variables, and Probability Distributions
Suggested Duration:	Four weeks

Interdisciplinary Connections

Interdisciplinary Connections
Reading and Writing Companion Standards for History, Social Studies, Science and Technical Subjects <ul style="list-style-type: none">▪ Grades 9-10▪ Grades 11-12
Math Practices: https://www.nj.gov/education/standards/math/Index.shtml
Science Practices: https://www.nj.gov/education/standards/science/Index.shtml
Find and paste appropriate <u>Companion Standards or Practices</u> here.

Real world Data will be used as part of each of the Learning Activities. Once the basic concepts and skills are Mastered, each activity and problem will use this knowledge and these skills to connect Mathematics to another discipline.

Technology Integration

Technology Integration
Northern supports the integration of the SAMR Model : a framework which extends learning through the use of technology. The installation of interactive boards, the purchase of softwares and subscriptions, and the investment in 1:1 laptops and various other instructional technologies are examples of Northern's commitment to enhancing students' learning and preparing the 21st century learner for college and careers.

Extensive use of TI-84, Stapplet, Google Classroom, AP Classroom, Desmos, and Khan Academy.

Standard(s) Addressed

Statistical Practices:

1. Formulate Questions: Determine an investigative question for a statistical study.
2. Collect Data: Identify and justify methods for collecting data and conducting statistical inference.
3. Analyze Data: Construct representations of data and calculate numerical statistical outputs.
4. Interpret Results: Interpret results and justify conclusions and methods.

Course Topics:

- 2.3 Estimating Probabilities Using Simulation
- 2.4 Introduction to Probability
- 2.5 Mutually Exclusive Events
- 2.6 Conditional Probability
- 2.7 Independent Events and Unions of Events
- 2.8 Introduction to Random Variables and Probability Distributions
- 2.9 Parameters of Random Variables
- 2.10 The Binomial Distribution

STAGE I Desired Results

STAGE I Desired Results
<i>Objective (Transfer)</i>
<i>Students will be able to independently use their learning to...</i>

Probabilistic reasoning allows statisticians to quantify the likelihood of random events over the long run and to make statistical inferences. Simulations and concrete examples can help students to understand the abstract definitions and calculations of probability. This unit builds on understandings of simulated or empirical data distributions and fundamental principles of probability to represent, interpret, and calculate parameters for theoretical probability distributions for discrete random variables. Interpretations of probabilities and parameters associated with a probability distribution should use appropriate units and relate to the context of the situation.

Mastery

Big Ideas/Understandings

Students will understand that...

BIG IDEA 1: VARIATION AND DISTRIBUTION (VAR)

The distribution of measures for individuals within a sample or population describes variation. The value of a statistic varies from sample to sample. How can we determine whether differences between measures represent random variation or meaningful distinctions? Statistical methods based on probabilistic reasoning provide the basis for shared understandings about variation and about the likelihood that variation between and among measures, samples, and populations is random or meaningful.

BIG IDEA 2: PATTERNS AND UNCERTAINTY (UNC)

Statistical tools allow us to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow us to anticipate patterns in data and to determine the likelihood of errors in inference.

Essential Questions

§ How can an event be both random and predictable?

§ About how many rolls of a fair six-sided die would we anticipate it taking to get three 1s?

Acquisition

Students will know . . .

Students will be skilled at . . .

[See “essential knowledge” in each topic of College Board CED for Unit 4](#)

Probability is a notoriously difficult topic for students to grasp because it’s difficult to conceptualize future outcomes in concrete ways. Before introducing new formulas, teachers can help students get an intuitive feel for why the formulas (and related notation) make sense. For example, the probability formulas for $P(A \text{ or } B)$ and for $P(A | B)$ can be presented intuitively with two-way tables. Simulations can also help students internalize what it means to quantify random behavior.

To help students understand when to apply different probability rules, teachers can use explicit strategies such as matching verbal scenarios to their corresponding probability formulas. Students frequently misinterpret probability distributions and parameters for random variables.

Teachers can reinforce that a complete interpretation will include context and units. A common misconception later in the course is that every question involving probability requires a significance test. Students should practice making predictions and decisions based on probability alone to avoid this misconception early on. They should revisit these problems in later units to practice differentiating between inference and probability problems.

STAGE II Assessment Evidence

STAGE II Assessment Evidence	
Evaluation	Assessments
Chapter evaluations in the format of AP exam (free responses and multiple choice based on chapter alignment of The Practice of Statistics)	Formative assessments will be based on FRQs from previous AP exams on topics at regular intervals in the chapter/unit.

Chapter 5: Probability

Chapter 6: Random Variables

Modifications

How are the evaluations/assessments modified/accelerated? (i.e.: alternate assessment). All courses follow a [balanced assessment system](#) with Practice, Assessments, Evaluations.

Modifications on 504 plans may be submitted at ([SSD](#)), prior to testing. Both exclusion **statements** and **extensions** exist for each standard to accommodate different paces.

STAGE III Learning Plan

STAGE III Learning Plan

Organize plan by weeks

[Day 1: Lesson 5.1 - Randomness & Probability](#)

[Day 2: Lesson 5.1 - Simulation](#)

[Day 3: Lesson 5.2 - Probability Rules](#)

[Day 4: Lesson 5.2 - General Addition Rule](#)

[Day 5: Quiz 5.1-5.2](#)

[Day 6: Lesson 5.3 - Independent & Dependent Events](#)

[Day 7: Lesson 5.3 - Conditional Probability & Tree Diagrams](#)

[Day 8: Quiz 5.3](#)

[Day 9: Chapter 5 Review](#)

[Day 10: Chapter 5 Test](#)

[Day 11: Lesson 6.1 - Discrete Random Variables](#)

[Day 12: Lesson 6.1 - Continuous Random Variables](#)

[Day 13: Lesson 6.2 - Transforming Random Variables](#)

[Day 14: Lesson 6.2 - Combining Random Variables](#)

[Day 15: Quiz 6.1-6.2](#)

[Day 16: Lesson 6.3 - Binomial Distributions Day 1](#)

[Day 17: Lesson 6.3 - Binomial Distributions Day 2](#)

[Day 18: Lesson 6.3 - Binomial Distributions Day 3](#)

[Day 19: Lesson 6.3 - Geometric Distributions](#)

[Day 20: Quiz 6.3](#)

[Day 21: Chapter 6 Review](#)

[Day 22: Chapter 6 Test](#)

Modifications

How are the activities modified/differentiated? (i.e.: abridged text)

Modifications on 504 plans may be submitted at [\(SSD\)](#). prior to testing. Both exclusion **statements** and **extensions** exist for each standard to accommodate different paces.

Specific Resources for Unit

Specific Resources for Unit
Attached Affirmative Action Compliance Checklist

[LP: AP Chapter 5 | StatsMedic](#)

[LP: AP Chapter 6 | StatsMedic](#)

[Probability | AP® Statistics | Math](#)

[Random variables | AP® Statistics | Math](#)

AP Classroom

Diversity, Equity, & Inclusion

Diversity, Equity & Inclusion
Provide a brief description of how this unit addresses DE&I.

Career Readiness (9.2), Life Literacies and Key Skills (9.4) Standards

- | | |
|--------------|--|
| WRK.K-12.P.1 | Act as a responsible and contributing community members and employee. |
| WRK.K-12.P.2 | Attend to financial well-being. |
| WRK.K-12.P.3 | Consider the environmental, social and economic impacts of decisions. |
| WRK.K-12.P.4 | Demonstrate creativity and innovation. |
| WRK.K-12.P.5 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| WRK.K-12.P.6 | Model integrity, ethical leadership and effective management. |
| WRK.K-12.P.7 | Plan education and career paths aligned to personal goals. |
| WRK.K-12.P.8 | Use technology to enhance productivity increase collaboration and communicate |

effectively.

WRK.K-12.P.9

Work productively in teams while using cultural/global competence.

Climate Change Education

ClimateChange Education	
Enduring Understandings/Core Ideas	Performance Expectations
Math and ELA- Provide a brief description of a lesson or activity that relates to Climate Change. All other Content Team copy and paste the <u>Core Idea and Performance Expectation</u> from NJDOE link above.	