

Unit Topic: Probability, Random Variables, and Probability Distributions
Grade level: AP Stats **Length of lesson:** 11 days

Stage 1 – Desired Results

Content Standard(s):

- HSS.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.
- HSS.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.
- HSS.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.
- HSS.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. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
- HSS.CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.
- HSS.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.
- HSS.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.
- HSS.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.
- HSS.CP.B.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Understanding (s)/goals

Students will understand:

- Given that variation may be random or not, conclusions are uncertain.
- Simulation allows us to anticipate patterns in data.
- The likelihood of a random event can be quantified.

Essential Question(s):

- 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?

- Probability distributions may be used to model variation in populations.
- Probabilistic reasoning allows us to anticipate patterns in data.

Student objectives (outcomes):

Students will be able to:

- Interpret probability as a long-run relative frequency.
- Use simulation to model a random process.
- Give a probability model for a random process with equally likely outcomes and use it to find the probability of an event.
- Use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.
- Use a two-way table or Venn diagram to model a random process and calculate probabilities involving two events.
- Apply the general addition rule to calculate probabilities.
- Calculate and interpret conditional probabilities.
- Determine whether two events are independent.
- Use the general multiplication rule to calculate probabilities.
- Use a tree diagram to model a random process involving a sequence of outcomes and to calculate probabilities.
- When appropriate, use the multiplication rule for independent events to calculate probabilities.
- Use the probability distribution of a discrete random variable to calculate the probability of an event.
- Make a histogram to display the probability distribution of a discrete random variable and describe its shape.
- Calculate and interpret the mean (expected value) of a discrete random variable.
- Calculate and interpret the standard deviation of a discrete random variable.
- Use the probability distribution of a continuous random variable (uniform or Normal) to calculate the probability of an event.
- Describe the effect of adding or subtracting a constant or multiplying or dividing by a constant on the probability distribution of a random variable. Calculate the mean and standard deviation of the sum or difference of random variables.
- Find probabilities involving the sum or difference of independent Normal random variables.
- Determine whether the conditions for a binomial setting are met.
- Calculate and interpret probabilities involving binomial distributions
- Calculate the mean and standard deviation of a binomial random variable. Interpret these values.
- When appropriate, use the Normal approximation to the binomial distribution to calculate probabilities.
- Calculate and interpret probabilities involving geometric random variables.
- Calculate the mean and standard deviation of a geometric distribution. Interpret these values

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Stage 2 – Assessment Evidence

Performance Task(s):	Other Evidence: <ul style="list-style-type: none">•
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Stage 3 – Learning Plan

Learning Activities:
