



Topic A:

Probability

S-IC.A.2, S-CP.A.1, S-CP.A.2, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7

Focus Standards:	S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g. using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>
	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”).
	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.
	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 .
	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. <i>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 results.</i>
	S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>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.</i>
	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.

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

Instructional Days: 7

Lesson 1: Chance Experiments, Sample Spaces, and Events (E)¹

Lesson 2: Calculating Probabilities of Events Using Two-Way Tables (P)

Lessons 3–4: Calculating Conditional Probabilities and Evaluating Independence Using Two-Way Tables (P, P)

Lesson 5: Events and Venn Diagrams (P)

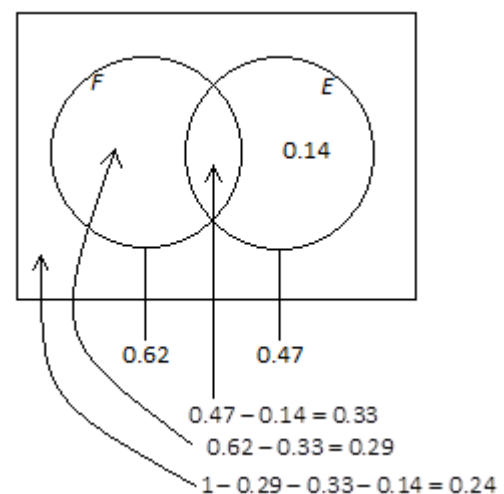
Lessons 6–7: Probability Rules (P, P)

Fundamental ideas from Grade 7 are revisited and extended to allow students to build a more formal understanding of probability. Students expand their understanding of chance experiments, sample space, and events to the more complex understanding of events defined as unions, intersections, and complements (**S-CP.A.1**). Students develop this understanding as they consider events that can be described as unions and intersections in the context of a game involving cards and spinners. One such game is introduced in Lesson 1, and then students explore further variations of the game in the lesson's Problem Set. Students also consider whether observations from a chance experiment are consistent with a given probability model (**S-IC.A.2**).

Students also calculate probabilities of unions and intersections using data in two-way data tables and interpret them in context (**S-CP.A.4**). Students deepen their understanding by creating “hypothetical 1000” two-way tables (i.e., tables based on a hypothetical population of 1000 observations) and then use these tables to calculate probabilities. Students use given probability information to determine the marginal totals and individual cell counts. This table then allows students to calculate conditional probabilities, as well as probabilities of unions, intersections, and complements, without the need for formal probability rules.

Students are introduced to conditional probability (**S-CP.A.3**, **S-CP.A.5**), which is used to illustrate the important concept of independence by describing two events, A and B , as independent if the conditional probability of A given B is not equal to the unconditional probability of A . In this case, knowing that event B has occurred does not change the assessment of the probability that event A has also occurred (**S-CP.A.2**, **S-CP.A.5**). Students use two-way tables to determine if two events are independent by calculating and interpreting conditional probabilities. In Lesson 3, students are presented with athletic participation data from Rufus King High School in two-way frequency tables, and conditional probabilities are calculated using column or row summaries. The conditional probabilities are then used to investigate whether or not there is a connection between two events.

Students are also introduced to Venn diagrams to represent the sample space and various events. Students will see how the regions of a Venn diagram connect to the cells of a two-way table. Venn diagrams also help students understand probability formulas involving the formal symbols of union, intersection, and complement. Additionally, a Venn diagram can show how subtracting the probability of an event from 1



¹ Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson

enables you acquire the probability of the complement of the event and why the probability of the intersection of two events is subtracted from the sum of event probabilities when calculating the probability of the union of two events.

The final lessons in this topic introduce probability rules (the multiplication rule for independent events, the addition rule for the union of two events, and the complement rule for the complement of an event) (**S-CP.B.6, S-CP.B.7**). Students use the multiplication rule for independent events to calculate the probability of the intersection of two events. Students interpret independence based on the conditional probability and its connection to the multiplication rule.