A2.6 Probability

• Describe events as subsets of a sample space (the set of outcomes) using characteristics of the outcomes or as unions, intersections, or complements of other subsets (“or,” “and,” “not”) (S-CP.A.1).
• Use the Addition Rule to compute probabilities of compound events in a uniform probability model, and interpret the result in terms of the model (S-CP.B.7).
• In a uniform probability model, understand the probability of A given B as the fraction of B's outcomes that also belong to A (S-CP.B.6).
• Understand the conditional probability of event A given event B as P(A and B)/P(B) (S-CP.A.3).
• Understand that A and B are independent if P(A and B) = P(A) • P(B) (S-CP.A.2).
• Interpret independence of A and B as saying that the probability of A given B is equal to the probability of A, and the probability of B given A is equal to the probability of B, i.e. P(A|B) = P(A) and P(B|A) = P(B) (S-CP.A.5).
• Recognize independence in everyday situations and explain it in everyday language (S-CP.A.5).
• Determine whether events are independent (S-CP.A.2, S-CP.A.4).
• Use data presented in two-way frequency tables to approximate conditional probabilities (S-CP.A.4).

In Grade 7, students encountered theoretical probability in the form of probability models and sample spaces, and experimental probability as in the form of long-run relative frequency. They found probabilities of compound events using lists, tables, tree diagrams, and simulation.

In this unit, the study of probability is extended to the notions of independence and conditional probability. Students learn about conditional probability and independence. Rather than summing probabilities of simple events or using simulations, they calculate probabilities of compound events in terms of probabilities of other compound events or by using frequency tables. The latter builds on work with two-way frequency tables from the One Variable Statistics unit.

Later, in the Making Inferences unit, students draw on their work with probability as well as their work with data in the One Variable Statistics and Bivariate Statistics unit to solve problems.

A2.6.0 Pre-unit diagnostic assessment

Assess students' ability to
• write about probability as a numerical measure of likelihood (7.SP.C.5);
• describe events as subsets of a sample space (S-CP.A.1);
• calculate probability of a compound event in a uniform probability model (S-CP.A.2);
• calculate probability of a compound event when relative frequencies are given (S-CP.A.2).

A2.6.1 Chance

Recall ideas they've already learned about probability and get excited about learning more.

This section is intended to activate students' prior knowledge of probability. The activities in this section are intended to create an intellectual need for the more precise terminology to be developed in the unit. Depending on time constraints, one, two, or three of these activities could be used to achieve the goals of this section.

Tasks
7.SP Red, Green, or Blue?

A2.6.2 The Addition Rule

• Describe events as subsets of a sample space (the set of outcomes) using characteristics of the outcomes or as unions, intersections, or complements of other events ("or", "and," "not") (S-CP.A.1).
• Develop the Addition Rule to compute probabilities of compound events in a uniform probability model (S-CP.B.7).
• Apply the Addition Rule in a uniform probability model and interpret the answer in terms of the model (S-CP.B.7).

In grade 7, students described sample spaces by creating lists, tables, and

diagrams. They determined P(A or B) by counting occurrences of simple events in A ∪ B. In this section, students learn to calculate P(A or B) in terms of P(A), P(B), and P(A and B). They begin by considering compound events as subsets of sample spaces, noting that in the sample space: the event "not A" is the complement of A; that the event "A and B" is the intersection of sets A and B; and that the event "A or B" is the union of A and B. The section culminates in a task where the Addition Rule is used to compute a probability.

Tasks

Describing Events
The Addition Rule
S-CP.7 Coffee at Mom's Diner

A2.6.3 Understanding independence and conditional probability

• Understand that two events A and B are independent if P(A and B) = P(A) • P(B) (S-CP.A.2).
• Understand the conditional probability of A given B as P(A and B)/P(B) (S-CP.A.3).
• Determine whether pairs of events are independent (S-CP.A.2).
• Find the conditional probability of A given B as the fraction of B's outcomes that also belong in A (S-CP.B.6).
• Recognize independence in everyday situations and explain it in everyday language (S-CP.A.5).

In this section, uniform probability models are the main context. Students examine situations involving pairs of independent and non-independent events, allowing them to learn to distinguish between such pairs. They calculate probabilities of compound events in uniform probability models, finding the conditional probability of A given B as the fraction of B's outcomes that are also in A. They note relationships such as P(A | B) = P(A and B)/P(B), and, when A and B are independent, P(A) = P(A | B).

Tasks

S-CP Lucky Envelopes
S-CP Cards and Independence
S-CP Breakfast Before School

A2.6.4 Using conditional probability to interpret data

Revisit two-way frequency tables and use them to approximate conditional probabilities (S-CP.A.4).

In the One Variable Statistics unit, students encountered two-way frequency tables. In this section, students revisit these tables, using them to approximate conditional probabilities by using the tables as a sample space.

Tasks
S-CP The Titanic 1

A2.6.5 Using conditional probability and independence to interpret data

Use data presented in two-way frequency tables to approximate conditional probabilities and to decide if events are independent (S-CP.A.4).

Students continue their work with two-way tables, using them to approximate conditional probabilities by using the tables as a sample space, and extending their work to consider independence.

Tasks
S-CP The Titanic 2
S-CP Rain and Lightning.

A2.6.6 Tying ideas together

• Interpret two-way frequency tables of data when two categories are associated with each object being classified, using the tables as a sample space in determining conditional probabilities and independence.
• Construct two-way frequency tables, use them to determine probabilities, and interpret these probabilities in the context of the data.

Students apply their knowledge of conditional probability and independence in tasks which are less structured than earlier tasks in the unit.

Tasks

S-CP The Titanic 3

A2.6.7 Summative Assessment

Assess students' ability to
• use the rules of probability to solve problems (multiplication and addition rules) (S-CP.A.1, S-CP.A.2, S-CP.B.7);
• use conditional probability to solve problems (S-CP.A.3);
• determine independence of events using the product rule and conditional probability (S-CP.A.4, S-CP.B.6);
• describe solutions to probabilistic situations using everyday language (S-CP.A.5).