

## M2.1 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").
- Use the Addition Rule to compute probabilities of compound events in a uniform probability model, and interpret the result in terms of the model.
- In a uniform probability model, understand the probability of A given B as the fraction of B's outcomes that also belong to A.
- Understand the conditional probability of event A given event B as  $P(A \text{ and } B)/P(B)$ .
- Understand that A and B are independent if  $P(A \text{ and } B) = P(A) \cdot P(B)$ .
- 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  $P(B|A) = P(B)$ .
- Recognize independence in everyday situations and explain it in everyday language.
- Determine whether events are independent.
- Use data presented in two-way frequency tables to approximate conditional probabilities.

In high school the study of probability is extended to the notions of independence and conditional probability. In contrast to grade 7 where students computed  $P(A \text{ or } B)$  by counting occurrences of simple events in  $A \cup B$ , students in this unit learn to calculate  $P(A \text{ or } B)$  in terms of  $P(A)$ ,  $P(B)$ , and  $P(A \text{ and } B)$ . 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 Addition Rule is developed and used to compute a probability. During this unit students examine situations involving pairs of independent and

non-independent events, learning to distinguish between such pairs in everyday situations. 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 observe and formalize relationships such as  $P(A|B) = P(A \text{ and } B)/P(B)$ , and, when A and B are independent,  $P(A) = P(A|B)$ . In a previous statistics unit, students encountered two-way frequency tables. In this unit, students revisit these tables as a way to approximate conditional probabilities by treating the tables as a sample space and extend their prior work to consider independence.

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 high school, 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 unit S1. In unit S4, students draw on their work with probability as well as their work with data in units S1 and S2 to solve problems.

## **M2.1.0 Pre-unit diagnostic assessment**

### **Diagnose students' ability to**

- **write about probability as a numerical measure of likelihood;**
- **describe events as subsets of a sample space;**
- **calculate probability of a compound event in a uniform probability model;**
- **calculate probability of a compound event when relative frequencies are given.**

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### **M2.1.1 Chance**

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

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as  $P(A|B) = P(A \text{ and } B)/P(B)$ , and, when A and B are independent,  $P(A) = P(A|B)$ . In a previous statistics unit, students encountered two-way frequency tables. In this unit, students revisit these tables as a way to approximate conditional probabilities by treating the tables as a sample space and extend their prior work to consider independence.

## M2.1.2 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”).**
- **Develop the Addition Rule to compute probabilities of compound events in a uniform probability model.**
- **Apply the Addition Rule in a uniform probability model and interpret the answer in terms of the model.**

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## **M2.1.3 Understanding independence and conditional probability**

- Understand that two events A and B are independent if  $P(A \text{ and } B) = P(A) \cdot P(B)$ .
- Understand the conditional probability of A given B as  $P(A \text{ and } B)/P(B)$ .
- Determine whether pairs of events are independent.
- Find the conditional probability of A given B as the fraction of B's outcomes that also belong in A.
- Recognize independence in everyday situations and explain it in everyday language.

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## **M2.1.4 Using conditional probability to interpret data**

**Revisit two-way frequency tables and use them to approximate conditional**

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### **M2.1.5 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.**

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### M2.1.6 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.**

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## **M2.1.7 Summative Assessment**

### **Assess students' ability to**

- **use the rules of probability to solve problems (multiplication and addition rules);**
- **use conditional probability to solve problems;**
- **determine independence of events using the product rule and conditional probability;**
- **describe solutions to probabilistic situations using everyday language.**

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