ELG HS.S.7: Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Vertical Progression:

7th Grade	**7.SP.C Investigate chance processes and develop, use and evaluate probability models.** o **7.SP.C.5** Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. o **7.SP.C.6** Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. o **7.SP.C.7** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. o **7.SP.C.7a** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. o **7.SP.C.7b** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
Algebra 2	**ELG.MA.HS.S.7 Use the rules of probability to compute probabilities of compound events in a uniform probability model.** o **S-CP.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. o **S-CP.7** Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
	ELG.MA.HS.S.7 Use the rules of probability to compute probabilities of compound events in a uniform probability model. o **S-CP.8 (+)** Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. o **S-CP.9 (+)** Use permutations and combinations to compute probabilities of compound events and solve problems.

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Students will demonstrate command of the ELG by:

- Calculating conditional probabilities using the definition: 'the conditional probability of A given B as the fraction of B's outcomes that also belong to A'.
- Interpreting the probability based on the context of the given problem.
- Identifying two events as disjoint (mutually exclusive).
- Calculating probabilities using the Addition Rule.
- Interpreting the probability of unions and intersections based on the context of the given problem.

Vocabulary:

- addition rule
- compound events
- conditional probability
- mutually exclusive
- uniform probability models
- Venn diagram

Sample Instructional/Assessment Tasks:

1) **Standard(s): S-CP.7**

Source: https://www.illustrativemathematics.org/content-standards/tasks/1024

Item Prompt:

At Mom's diner, everyone drinks coffee. Let $C =$ the event that a randomly-selected customer puts cream in their coffee. Let $S =$ the event that a randomly-selected customer puts sugar in their coffee. Suppose that after years of collecting data, Mom has estimated the following probabilities:

$$P(C) = 0.6$$
$$P(S) = 0.5$$
$$P(C \text{ or } S) = 0.7$$

Estimate $P(C \text{ and } S)$ and interpret this value in the context of the problem.

Correct Answer:

Using the addition rule, $P(C \text{ or } S) = P(C) + P(S) - P(C \text{ and } S)$, it follows that:

$$\begin{aligned} 0.7 &= 0.6 + 0.5 - P(C \text{ and } S) \\ P(C \text{ and } S) &= 0.6 + 0.5 - 0.7 \\ &= 0.4 \end{aligned}$$

The probability that a randomly-selected customer at Mom's has both cream and sugar in his or her coffee is 0.4.

2) **Standard(s): S-CP.4, 6**

Source: https://www.illustrativemathematics.org/content-standards/tasks/1024

Item Prompt:

All of the upper-division students (juniors and seniors) at a high school were classified according to grade level and response to the question "How do you usually get to school?" The resulting data are summarized in the two-way table below.

	Car	Bus	Walk	Totals
Juniors	96	122	56	274
Seniors	184	58	30	272
Totals	280	180	86	546

a. If an upper-division student at this school is selected at random, what is the probability that this student usually takes a bus to school?

i. $\frac{58}{272}$

ii. $\frac{180}{546}$

iii. $\frac{122}{274}$

iv. $\frac{58}{122}$

v. $\frac{272}{546}$

b. If a randomly selected upper-division student says he or she is a junior, what is the probability that heor she usually walks to school?

i. $\frac{56}{546}$

ii. $\frac{86}{546}$

iii. $\frac{56}{274}$

iv. $\frac{86}{274}$

v. $\frac{274}{546}$

Correct Answer:

a. Answer is (ii). $P(\text{Bus}) = \frac{180}{546} = 0.330$

b. Answer is (iii). $P(\text{Walks}|\text{Junior}) = \frac{56}{274} = 0.204$