

Core Content

Cluster Title: Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Standard 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.

Concepts and Skills to Master

- Find and interpret conditional probabilities using a two-way table, Venn diagram, or tree diagram.
- Understand the difference between compound and conditional probabilities.

Supports for Teachers

Critical Background Knowledge

- Find probabilities of compound events. (7.SP.8)
- Summarize categorical data in two-way frequency tables. (I.4.S.ID.5)

Academic Vocabulary

random variable, probability model

Suggested Instructional Strategies

- Make a “human Venn diagram” where the sample space is all the students in the class. Use lengths of rope to create three overlapping circles. Assign an event to each of the three circles, such as: ate breakfast, brought a cell phone to school, and got at least 7 hours of sleep. Have students place themselves in the appropriate locations. Using correct probability notation, identify each of the spaces in the Venn diagram (don’t forget to include the space outside the circles). Analyze, explore and record the results in terms of conditional probabilities.
- Connect to probability models from other standards.

Resources

Sample Formative Assessment Tasks

Skill-Based Task:

From the table, determine the probability of getting the flu, and compare that to the probability of getting the flu given that an individual takes high doses of vitamin C.

	Cold	No Cold	Total
Placebo	31	109	140
Vitamin C	17	122	139
Total	48	231	279

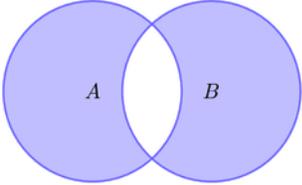
Problem Task:

Life is like a box of chocolates. Suppose your box of 36 chocolates have some dark and some milk chocolate, divided into cream or nutty centers. Out of the dark chocolates, 8 have nutty centers. Out of the milk chocolates, 6 have nutty centers. One-third of the chocolates are dark chocolate. What is the probability that you randomly select a chocolate with a nutty center? Given that it has a nutty center, what is the probability you chose a dark chocolate? Show how you determined your answers.

Core Content

Cluster Title: Use the rules of probability to compute probabilities of compound events in a uniform probability model.
Standard S.CP.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.
Concepts and Skills to Master
<ul style="list-style-type: none"> Define the probability of event (A or B) as the probability of their union. Understand and use the formula $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$.

Supports for Teachers

Critical Background Knowledge													
<ul style="list-style-type: none"> Find probabilities of compound events (7.SP.8). 													
Academic Vocabulary													
or, and, $P(A)$, \cup , \cap													
Suggested Instructional Strategies	Resources												
<ul style="list-style-type: none"> Make a connection between the formula for the addition rule and a probability model. 													
Sample Formative Assessment Tasks													
<p>Skill-Based Task Given the following table, which includes data regarding boating preferences of boys and girls, use the Addition Rule to find $P(L \cup G)$.</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>Lake (L)</th> <th>River (R)</th> </tr> </thead> <tbody> <tr> <td>Girls (G)</td> <td>21</td> <td>29</td> </tr> <tr> <td>Boys (B)</td> <td>32</td> <td>18</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Lake (L)	River (R)	Girls (G)	21	29	Boys (B)	32	18				<p>Problem Task Sally shaded the following Venn diagram to illustrate the Addition Rule. What was wrong with her reasoning? How could you represent the addition rule pictorially?</p> <div style="text-align: right;">  </div>
	Lake (L)	River (R)											
Girls (G)	21	29											
Boys (B)	32	18											

Core Content

Cluster Title: Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Standard S.CP.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.

Concepts and Skills to Master

- Define the probability of event (*A and B*) as the probability of the intersection of events *A* and *B*.
- Understand $P(B|A)$ to mean the probability of event *B* occurring when *A* has already occurred.
- Use the multiplication rule, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, to determine $P(A \text{ and } B)$.
- Determine the probability of dependent and independent events in real contexts.

Supports for Teachers

Critical Background Knowledge

- Probabilities of compound events and tree diagrams. (7.SP.8)
- Sample space, sets, subsets, outcomes, events, union, intersection, “and”, “or”. (II.4.S.CP.1)
- Conditional probability. (II.4.S.CP.3)
- Two-way tables. (II.4.S.CP.4)

Academic Vocabulary

uniform probability model, multiplication rule, $P(A)$, $P(A|B)$, $P(A \cap B)$

Suggested Instructional Strategies

- Apply and interpret the multiplication rule to a variety of contextual events.
- Illustrate the multiplication rule with tree diagrams, Venn diagrams and two-way tables.

Resources

Sample Formative Assessment Tasks

Skill-Based Task:

Given the following table, which includes data regarding boating preferences of boys and girls, find the probability that a randomly chosen student is a girl who prefers lake boating.

	Lake (L)	River (R)
Girls (G)	21	29
Boys (B)	32	18

Problem Task:

The probability that a student passes the written portion of a driving test is 62%. The probability that a student passes the driving part of the test is 86%. Draw a diagram to clearly demonstrate the probability that a student passes both tests.

Core Content

Cluster Title: Use the rules of probability to compute probabilities of compound events in a uniform probability model.
Standard S.CP.9: Use permutations and combinations to compute probabilities of compound events and solve problems.
Concepts and Skills to Master
<ul style="list-style-type: none"> Define $n!$ as the product: $n \cdot (n - 1) \cdot \dots \cdot 3 \cdot 2 \cdot 1$. Understand that a permutation is a rearrangement of the elements of an ordered list and calculate probabilities using the permutation formula $P(n,r) = n \cdot (n - 1) \cdot \dots \cdot (n - (r - 1)) = n!/(n - r)!$. Understand that a combination is the number of ways to choose r items from a set of n elements and calculate probabilities using the combination formula $C(n,r) = P(n,r)/r! = n!/[(n - r)! r!]$.

Supports for Teachers

Critical Background Knowledge	
<ul style="list-style-type: none"> Probabilities of compound events (7.SP.8). Conditional probability (II.4.S.CP.3). Multiplication rule of probability (II.4.S.CP.8 (+)). 	
Academic Vocabulary	
factorial, permutation, combination, $P(n,r)$, ${}_nP_r$, $C(n,r)$, ${}_nC_r$, $\binom{n}{r}$	
Suggested Instructional Strategies	Resources
<ul style="list-style-type: none"> Embed combination and permutation explorations in contextual situations. 	Permutations and Combinations: http://mathforum.org
Sample Formative Assessment Tasks	
<p>Skill-Based Task: Given the set of ice cream flavors {chocolate, strawberry, vanilla}, list all possible two-scoop cones, and find the probability that a randomly selected cone includes chocolate.</p>	<p>Problem Task: Referring to the skill-based task, consider all possible sets of two-scoop cones. How would you define “two-scoop cone” in order to be a permutation? What part of your definition would you change to define the cones as a combination? How do the probabilities of getting chocolate change in each setting?</p>