

Rules Of Probability

1. Addition Rule (for Mutually Exclusive Events):

- If two events (A and B) cannot happen at the same time (like getting heads and tails in one flip), the probability of either A or B happening is the sum of their individual probabilities.
 - $P(A \text{ or } B) = P(A) + P(B)$

Example: Probability of rolling a 3 or a 4 on a fair die.

- Events A (rolling a 3) and B (rolling a 4) are mutually exclusive.
- $P(3 \text{ or } 4) = P(3) + P(4) = 1/6 \text{ (for each number)} = 1/3$.

2. Complementary Rule:

- The probability of the event NOT happening (E^*) is 1 minus the probability of the event happening (E).
 - $P(E^*) = 1 - P(E)$

Example: Probability of NOT getting heads when flipping a fair coin.

- $P(\text{not heads}) = 1 - P(\text{heads}) = 1 - 1/2 = 1/2$ (since tails is the complementary event).

3. Multiplication Rule (for Independent Events):

- If two events (A and B) are independent (the occurrence of one doesn't affect the other), the probability of both A and B happening is the product of their individual probabilities.

- $P(A \text{ and } B) = P(A) * P(B)$

Example: Probability of rolling a 2 on a fair die and then flipping heads on a separate coin flip (assuming independence).

- $P(2 \text{ and heads}) = P(2) * P(\text{heads}) = 1/6 \text{ (for 2)} * 1/2 \text{ (for heads)} = 1/12.$

4. Conditional Probability:

- This is the probability of event B happening given that event A has already occurred.
 - Formula: $P(B \mid A) = P(A \text{ and } B) / P(A)$

Example: Imagine a bag with 2 red candies (R) and 3 blue candies (B). You draw a red candy (event A) and don't put it back. What's the probability of then drawing a blue candy (event B)?

- $P(\text{blue} \mid \text{red}) = P(\text{red and blue}) / P(\text{red}) = (\text{probability of drawing a blue candy after taking out a red candy}) / (\text{probability of drawing a red candy in the first place}).$