

# Bayes Theorem: Takeaways

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## Concepts

- Independence, dependence, and exclusivity describe the relationship between events (two or more events), and they have different mathematical meanings:

$$\text{Independence} \implies P(A \cap B) = P(A) \cdot P(B)$$

$$\text{Dependence} \implies P(A \cap B) = P(A) \cdot P(B|A)$$

$$\text{Exclusivity} \implies P(A \cap B) = 0$$

- If two events are **exhaustive**, it means they make up the whole sample space  $\Omega$ .
- The law of total probability** can be expressed mathematically as:

$$P(A) = P(B_1) \cdot P(A|B_1) + P(B_2) \cdot P(A|B_2) + \dots + P(B_n) \cdot$$

- The law of total probability is often written using the summation sign  $\Sigma$ :

$$P(A) = \sum_{i=1}^n P(B_i) \cdot P(A|B_i)$$

- For any events A and B, we can use **Bayes' theorem** to calculate  $P(A|B)$ :

$$P(A|B) = \frac{P(A) \cdot P(B|A)}{\sum_{i=1}^n P(A_i) \cdot P(B|A_i)}$$

- $P(A|B)$  is the **posterior probability** of A *after* B happens ("posterior" means "after").  $P(A)$  is the **prior probability** of A *before* B happens ("prior" means "before").

## Resources

- [An intuitive approach to understanding Bayes' theorem](#)
- [False positives, false negatives, and Bayes' theorem](#)



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