Probability Class 12 Formula Sheet

CBSE Class 12 Maths · NCERT · for boards, NEET and JEE revision

ChapterNotes

1. Conditional Probability

The probability of event E given that event F has already occurred:
$P(E|F) = P(E \cap F) / P(F)$, provided $P(F) \neq 0$
Properties:
• $P(S|F) = 1$ (where S is sample space)
• $P(E'|F) = 1 - P(E|F)$
• $P((A \cup B)|F) = P(A|F) + P(B|F) - P(A \cap B|F)$

2. Multiplication Theorem

$P(A \cap B) = P(A) \times P(B|A) = P(B) \times P(A|B)$
For three events:
$P(A \cap B \cap C) = P(A) \times P(B|A) \times P(C|A \cap B)$

3. Independent Events

Events A and B are independent if:
$P(A \cap B) = P(A) \times P(B)$
Equivalently: $P(A|B) = P(A)$ and $P(B|A) = P(B)$
(Knowing one event doesn't change the probability of the other)

4. Total Probability Theorem

If $E_1, E_2, ..., E_n$ form a partition of sample space S (mutually exclusive and exhaustive), then for any event A:
$P(A) = P(E_1)P(A|E_1) + P(E_2)P(A|E_2) + ... + P(E_n)P(A|E_n)$
$= \sum P(E_i) \times P(A|E_i)$

5. Bayes' Theorem

$P(E_i|A) = P(E_i) \times P(A|E_i) / \sum P(E_j) \times P(A|E_j)$
In words: **Posterior = (Prior × Likelihood) / Evidence**

6. Random Variable and Probability Distribution

Probability Distribution: A table listing all possible values of X with their probabilities.
Requirements:
• $0 \leq P(X = x_i) \leq 1$ for each value
• **$\sum P(X = x_i) = 1$** (probabilities must sum to 1)

7. Mean and Variance of a Random Variable

Mean (Expected Value): $E(X) = \mu = \sum x_i \times P(x_i)$
Variance: $Var(X) = E(X^2) - [E(X)]^2 = \sum x_i^2 \times P(x_i) - \mu^2$
Standard Deviation: $\sigma = \sqrt{Var(X)}$

8. Bernoulli Trials and Binomial Distribution

Bernoulli Trial: An experiment with exactly two outcomes - Success (p) and Failure (q = 1−p)
Binomial Distribution: For n independent Bernoulli trials:
$P(X = r) = {}^nC_r \times p^r \times q^{(n-r)}$
where r = 0, 1, 2, ..., n
Mean: $E(X) = np$
Variance: $Var(X) = npq$

Quick revision

- $P(A|B) = P(A \cap B)/P(B)$ - "reduce" the sample space to B
- Independent $\Rightarrow P(A \cap B) = P(A) \times P(B)$; do NOT confuse with mutually exclusive
- Bayes' theorem reverses conditional probability: effect → cause
- Total probability = weighted sum over partition
- Probability distribution: all P(X) must be between 0 and 1, and sum to 1
- Mean $E(X) = \sum x_i P(x_i)$, Variance $= E(X^2) - [E(X)]^2$
- Binomial: $P(X=r) = {}^nC_r\, p^r\, q^{n-r}$, Mean = np, Variance = npq
- Bayes' theorem problems are very common (5 marks) - practice the table method!

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-maths/probability-class-12-notes/