Guide to:
Conditional probability

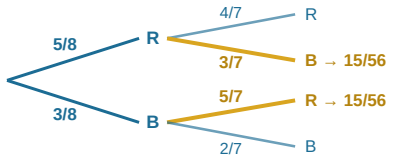
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Explanation:

Conditional probability occurs when one event changes the probabilities for the next event, most commonly when items are chosen **without replacement**. On a tree diagram, always reduce both the **total denominator by 1** on the second set of branches and the numerator by 1 for whichever item was picked first.

Multiply along branches for **AND**, and add the results of separate paths for **OR**. For "at least one" or "two of the same colour", you can also use **1 − P(opposite event)** as a fast check. For Venn diagrams or two-way tables, restrict the denominator strictly to the "given" group.

Example 1: A bag has 5 red and 3 blue counters. Two are taken at random without replacement. Find P(one of each colour).



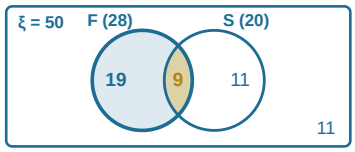
Solution:

P(R, B) = $\frac{5}{8} \times \frac{3}{7} = \frac{15}{56}$; P(B, R) = $\frac{3}{8} \times \frac{5}{7} = \frac{15}{56}$

Add both paths: $\frac{15}{56} + \frac{15}{56} = \frac{30}{56}$

Answer: $\frac{30}{56}$ (or $\frac{15}{28}$)

Example 2: In a group of 50 students, 28 study French, 20 study Spanish, and 9 study both. Given a student studies French, find P(studies Spanish).



Solution:

Restrict sample space to the **28 French students**:
Number in French circle also in Spanish = **9**

P(Spanish | French) = $\frac{n(F \cap S)}{n(F)} = \frac{9}{28}$

Answer: $\frac{9}{28}$

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