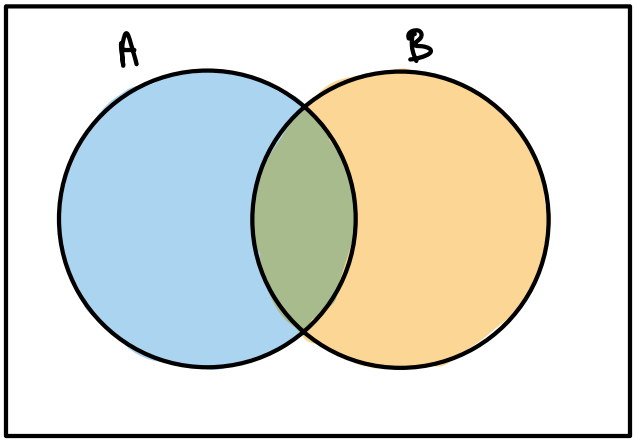
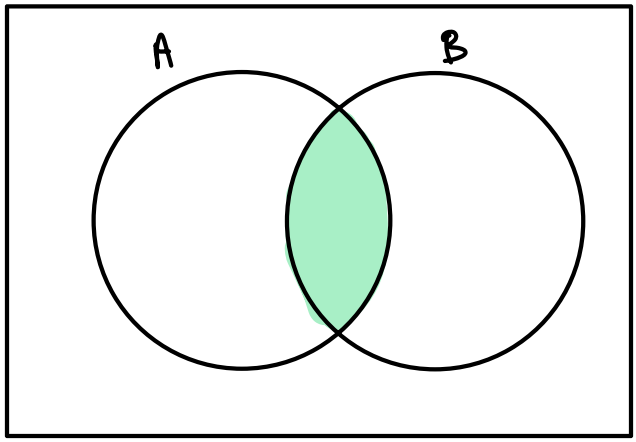
MULTIPLICATION



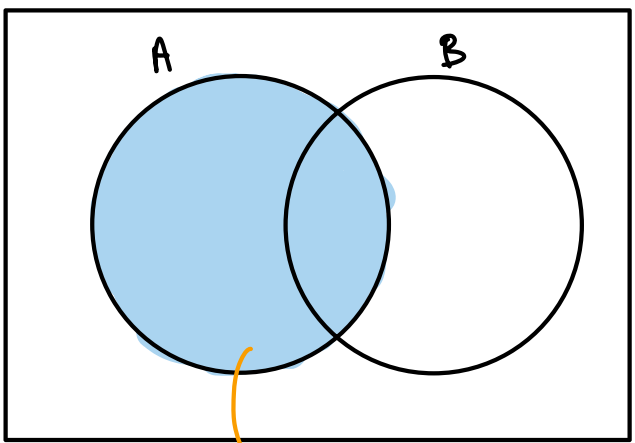


region of interest

What is the probability of $A \cap B$

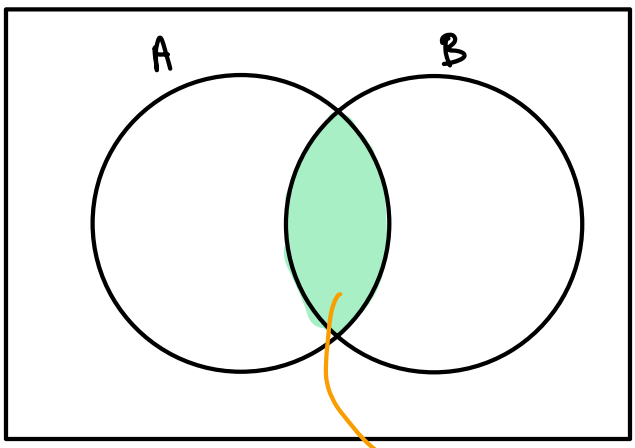
One way to think about this is that the region of interest is $A \cap B$ (green region).

Once A has happened, our outcome space shrinks to



new outcome space

Now, the probability of B happening, given A has happened is simply $A \cap B$



favourable region

probability of B happening given that A has already happened

$P(B|A)$ = favourable region / new outcome space

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$ } Division Rule.

Re-arrange to get

$P(A \cap B) = P(A)P(B|A)$ → multiplication rule.