Conditional Probability

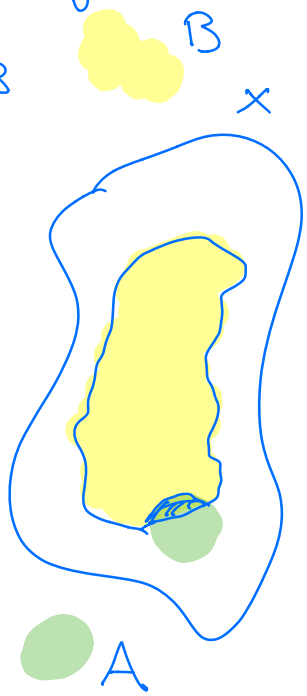
X = deck of 52 cards
draw a card at random.

$P(\{\text{king}\}) = 4/52 = 1/13$

You somehow learn that your card is a face card.

$P(\{\text{king}\} \mid \{\text{face card}\}) = 4/12 = 1/3$

12 face cards



Def: A, B be 2 events

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

Theorem: (Bayes Theorem)

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Proof $P(B|A)P(A) = P(A \cap B)$

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