Full Laws of Probability

If events A and B are <u>independent</u>.

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

If events A and B are <u>mutually exclusive</u>:

$$P(A \cap B) =$$
$$P(A \cup B) =$$

In general:

$$P(A|B) =$$

$$P(A \cup B) =$$

Example

Edexcel S1

6. Explain what you understand by
(a) a sample space, **(1)**
(b) an event. **(1)**

Two events A and B are independent, such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$

Find
(c) $P(A \cap B)$, **(1)**
(d) $P(A \mid B)$, **(2)**
(e) $P(A \cup B)$. **(2)**

Further Examples

[Textbook] C and D are two events such that $P(C) = 0.2$, $P(D) = 0.6$ and $P(C|D) = 0.3$. Find:
a. $P(C \cap D)$ b. $P(D|C)$ c. $P(C \cup D)$

10. [Jan 2012 Q2] (a) State in words the relationship between two events R and S when $P(R \cap S) = 0$. **(1)**

The events A and B are independent with $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{2}{3}$. Find

(*b*) $P(B)$, **(4)**
(*c*) $P(A' \cap B)$, **(2)**
(*d*) $P(B'|A)$. **(2)**

(a)

(b)

(c)

(d)

Test Your Understanding

Edexcel S1

9. Three events A, B and C are defined in the sample space S. The events A and B are mutually exclusive and A and C are independent.

(a) Draw a Venn diagram to illustrate the relationships between the 3 events and the sample space. **(3)**

Given that $P(A) = 0.2$, $P(B) = 0.4$ and $P(A \cup C) = 0.7$, find

(b) $P(A \mid C)$, **(2)**

(c) $P(A \cup B)$, **(2)**

(d) $P(C)$. **(4)**

a)

b)

c)

d)

SUPER IMPORTANT TIPS

If I were to identify two tips that will possible help you the most in probability questions:

If you see the words '**given that**', Immediately write out the law for conditional probability.

Example: "Given Bob walks to school, find the probability that he's not late…"

First thing you should write:

If you see the words '**are independent**', Immediately write out the laws for independence.
(Even before you've finished reading the question!)

Example: "A is independent from B…"

First thing you should write:

If you're stuck on a question where you have to find a probability given others, it's probably because you've failed to take into account that two events are independent or mutually exclusive, or you need to use the conditional probability or additional law.