Basic of Probability

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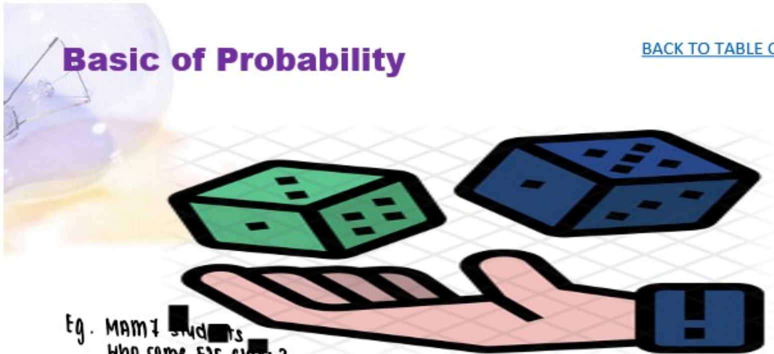


Eg. MAM7 [redacted] stud[redacted]ts
Who come F2F class?

→ eg. $S = \{1, 2, 3 \dots 26\}$

eg.
26 students = 26 outcomes

→ eg. come F2F & X come F2F class

outcome = sample point

In probability, an ① **experiment** has a number of ② **outcomes**. Each outcome is called a ③ **sample point** and the ④ **sample space** of an experiment is all possible outcomes. An ⑤ **event** is a subset of the sample space.

↳ curly bracket
↳ sample space diagram

Consider the spinner shown here. If event A is defined as 'an even number' and event B is defined as 'a multiple of 3', then:

$$A = \{2, 4, 6, 8, 10\}$$

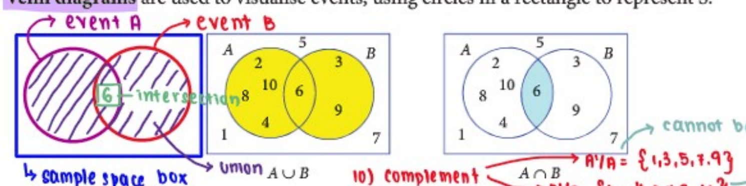
and $$B = \{3, 6, 9\}.$$

The ⑥ **sample space** S is the set of individual possible occurrences, so in this case, $S = \{1, 2, 3, \dots, 10\}$.

** The ⑦ **union** ($\cup$) of A and B is the combination of either event A or event B or both A and B occurring. So $A \cup B = \{2, 3, 4, 6, 8, 9, 10\}$. includes 1 event = fulfil A or B then can

** The ⑧ **intersection** ($\cap$) of A and B is the event that both A and B occur and includes the sample points that are common to A and B. So $A \cap B = \{6\}$. both also have → similarity = must fulfil both A & B

** ⑨ **Venn diagrams** are used to visualise events, using circles in a rectangle to represent S.



The probability of an event is the likelihood or chance of it occurring, so $P(A) = \frac{5}{9}$ and $P(A \cup B) = \frac{7}{9}$

IMPORTANT

The **probability** of an event A in a sample space S is written as $P(A)$ and is a real number between 0 and 1. The probability of the sample space, $P(S) = 1$ and the probability of a union of disjoint events is the sum of their probabilities.

For a finite sample space whose elements have equal probabilities,

$$P(A) = \frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}} = \frac{n(A)}{n(S)}$$

If $P(A) = 1$, then event A is **certain** to occur.

If $P(A) = 0$, then event A is **impossible**.

The **complement** of event A is represented as A' or $\bar{A}$. A' means 'not A', so $P(A')$ is the probability that A will not occur.

$$P(A) + P(A') = 1$$

$$P(A') = 1 - P(A)$$

PROBABILITY

→ posibility = likelihood
= chances

→ range: $0\% \leq P(\text{any event}) \leq 100\%$
$0 \leq P(\text{any event}) \leq 1$

→ representation: → decimal (4s.f.)
↳ fraction

You can use Venn diagrams, tree diagrams, tables and grids to help calculate the probabilities of events. You can also use the following rules.

Eg. $A = \{2, 4, 6, 8, 10\}$
$B = \{3, 6, 9\}$
$A \cup B = \{2, 3, 4, 6, 8, 9, 10\}$
$A \cap B = \{6\}$

IMPORTANT

The **addition rule** of probability states that:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$ = in standard formula sheet

$P(A \cup B)$ is also written as $P(A \text{ or } B)$.

$P(A \cap B)$ is also written as $P(A \text{ and } B)$.

Mutually exclusive events cannot occur simultaneously, so $P(A \cap B) = 0$. For mutually

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Mutually exclusive events cannot occur simultaneously, so $P(A \cap B) = 0$. For mutually exclusive events: $P(A \cup B) = P(A) + P(B)$

P(A|B) = probability of event A to happen given that event B has already happen

P(B/A) ? other way around

The **conditional probability** of event A given event B is written as $P(A|B)$ or 'the probability of A given B' and defined as $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$.

The **multiplication rule** for any events A and B is $P(A \cap B) = P(A|B) \times P(B)$.

Events are **independent** if $P(A|B) = P(A)$. The outcome of one does not affect the probability of the other, so $P(A \cap B) = P(A) \times P(B)$.

Please try the revision exercises on probability below:

☺ **Revision Exercises**

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

$$P(B/A) = P(B)$$

$A \cap B = \{6\}$

① $P(A) = \frac{5}{10} = 0.5 = 50\%$

② $P(B) = \frac{3}{10} = 0.3 = 30\%$

③ $P(A \cup B) = \frac{7}{10} = 0.7 = 70\%$

④ $P(A \cap B) = \frac{1}{10} = 0.1 = 10\%$

⑤ $P(A') = \frac{5}{10} = 0.5 = 50\%$

⑥ $P(B') = \frac{7}{10} = 0.7 = 70\%$

normal

$\boxed{\text{Type of events}}$

mutually exclusive
- ↳ both events cannot happen at same time
- ↳ eg. day & night

independant
- ↳ both events can happen at same time
- ↳ But! it wouldn't affect the results of the other

	$P(A \cup B)$	$P(A \cap B)$	$P(A|B)$	$P(B|A)$
mutually exclusive	$P(A) + P(B) - P(A \cap B)$	$P(A|B) \times P(B)$	$\frac{P(A \cap B)}{P(B)}$	$\frac{P(A \cap B)}{P(A)}$
independant	$P(A) + P(B)$	0	0	0
normal	$P(A) + P(B) - (P(A) + P(B))$	$P(A) \times P(B)$	$P(A)$	$P(B)$