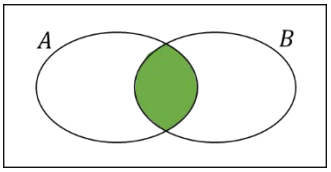
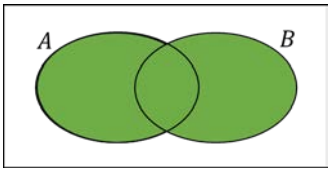
PROBABILITY | KEY POINTS

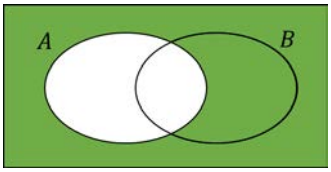
- An ***experiment*** is a repeatable process that gives rise a number of ***outcomes***.
- An ***event*** is a set of one or more of these ***outcomes*** (we often use capital letters to represent them).
- A ***sample space*** is the set of all possible outcomes.



The event "A and B"
Known as the **intersection** of A and B.
In set notation: $P(A \cap B)$



The event "A or B"
Known as the **union** of A and B.
In set notation: $P(A \cup B)$



The event "not A"
Known as the **complement** of A.
In set notation: $\mathrm{P}(A')$

- $\mathrm{P}(A') = 1 - \mathrm{P}(A)$ (the complement of an event)
- $\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A \cap B)$ (addition property)

BASIC PROBABILITY | EXAMPLE-PROBLEM PAIR

1E. A card is picked at random from a pack of cards.
Find the probability of the events below. Use set notation for your answers.
Card is a club = event C Card is a queen = event Q

(a) A club is picked

(b) A queen is picked

(c) The queen of clubs is picked.

(d) A club or a queen is picked.

(e) A club is not picked.

1P. A card is picked at random from a pack of cards.
Find the probability of the events below. Use set notation for your answers.
Card is a heart = event H Card is a picture card = event C

(a) A picture card is picked

(b) A heart is picked

(d) The card is both a heart and a picture card.

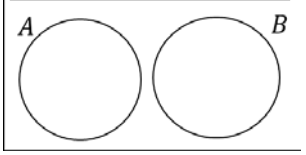
(d) The card is not a picture card.

(e) The card is not a heart and not a picture card.

MUTUALLY EXCLUSIVE EVENTS AND INDEPENDENT EVENTS | KEY POINTS

- Two events are **mutually exclusive** if they can't happen at the same time.
- If A and B are mutually exclusive events, then:
  - $\mathrm{P}(A \cap B) = 0$
  - $\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B)$
- Two events are independent if whether one event happens does not affect the probability of the other event happening.
  - $\mathrm{P}(A \cap B) = \mathrm{P}(A) \times \mathrm{P}(B)$

MUTUALLY EXCLUSIVE EVENTS



Since $P(A \cap B) = 0$, there can't be any outcomes in the overlap, so we don't have an overlap!

2P. For the two events A and B, $\mathrm{P}(A) = 0.38$, $\mathrm{P}(B) = 0.24$ and $\mathrm{P}(A \cup B) = 0.6$.

Show whether or not the two events are mutually exclusive.

Draw a Venn Diagram to illustrate the situation.2

2E. A fair six-sided die is rolled once. In each cause, state whether the two events are mutually exclusive and write down the value of $\mathrm{P}(A)$, $\mathrm{P}(B)$ and $\mathrm{P}(A \cup B)$.

(a) A: Rolling a 5. B: Rolling a 6.

(b) A: Rolling an even number. B: Rolling a prime number.

3E. A scientist is investigating the likelihood that a person will catch two infectious diseases, after being exposed to one and then the other.
The probability of catching the first disease is 0.25, the probability of catching the second disease is 0.5, and the probability of catching both diseases is 0.2.

Let A be the event 'catch the first disease'. Let B be the event 'catch the second disease'. Show that A and B are independent.

3P. (a) I pick one of the four numbers 1, 2, 3, 4 at random. What is the probability that:

(i) I pick a multiple of 2 (event A).
(ii) I pick a multiple of 4 (event B).

(b) Show that the events are not independent.

4P. There are 3 yellow and 2 green counters in a bag. I take two counters at random. Determine the probability that:

(a) They are of the same colour.
(b) They are of different colours

4E. A bag contains 6 green and 4 blue counters. A counter is chosen at random from the bag three times without replacement. Find the probability that the three counters chosen are:
(a) All green
(b) Not the same colour.