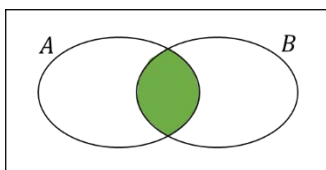


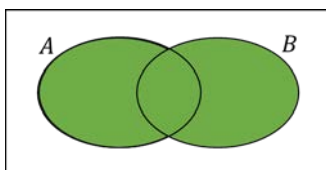


PROBABILITY | KEY POINTS

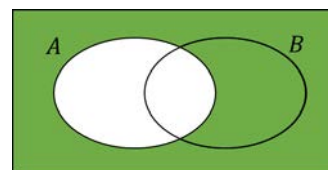
- An **experiment** is a repeatable process that gives rise a number of **outcomes**.
- An **event** is a set of one or more of these **outcomes** (we often use capital letters to represent them).
- A **sample space** is the set of all possible outcomes.



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:  $P(A')$

- $P(A') = 1 - P(A)$  (the complement of an event)
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$  (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.

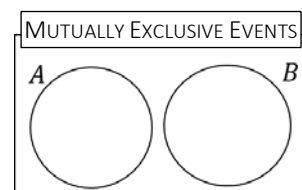
Find the probability of the events below. Use set notation for your answers.

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:
  - o  $P(A \cap B) = 0$
  - o  $P(A \cup B) = P(A) + P(B)$
- Two events are independent if whether one event happens does not affect the probability of the other event happening.
  - o  $P(A \cap B) = P(A) \times P(B)$



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



MUTUALLY EXCLUSIVE EVENTS AND INDEPENDENT EVENTS | EXAMPLE-PROBLEM PAIRS

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

Show whether or not the two events are mutually exclusive.

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Draw a Venn Diagram to illustrate the situation.2

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 not independent.

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4P. There are 3 yellow and 2 green counters in a bag. I take two counters at random without replacement. Determine the probability that:

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

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

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

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

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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  $B$ ).

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- (b) Show that the events are not independent.

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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 all the same colour.