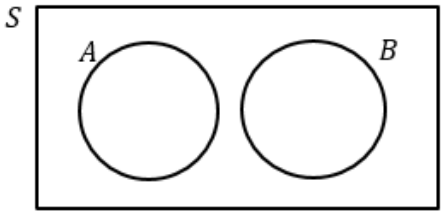
Mutually Exclusive Events

- If two events are mutually exclusive **they can't happen at the same time**.
- If A and B are mutually exclusive then:
  - $\boldsymbol{P(A \text{ and } B) = 0}$
  - $\boldsymbol{P(A \text{ or } B) = P(A) + P(B)}$
- The Venn Diagram would look like:



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

Independent Events

- If two events are independent
- If A and B are independent then:

Fro Note: Independence does not affect how the circles interact in a Venn Diagram.

Example

1 2 3 4

1 I pick one of the four numbers 1, 2, 3, 4 at random. What's the probability that:

a) I pick a multiple of 2:

b) I pick a multiple of 4:

2 Explain (conceptually) why these two events are not independent.

3 Show that the events are not independent.

$$P(multiple\ of\ 2) \times P(multiple\ of\ 4) =$$

$$P(multiple\ of\ 2\ \boldsymbol{and}\ multiple\ of\ 4) =$$

This is a common exam question. Either show that $P(A \text{ and } B) = P(A) \times P(B)$ or that $P(A \text{ and } B) \neq P(A) \times P(B)$

Further Examples

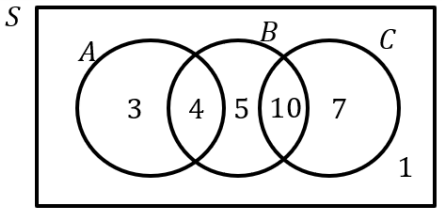
[Textbook] Events A and B are mutually exclusive and $P(A) = 0.2$ and $P(B) = 0.4$.

a) Find $P(A \text{ or } B)$
b) Find $P(A \text{ but not } B)$
c) Find $P(\text{neither } A \text{ nor } B)$

[Textbook] Events A and B are independent and $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{5}$. Find $P(A \text{ and } B)$.

[Textbook] The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes.

a) Find the probability that a student chosen at random watches B or C or both.
b) Determine whether watching A and watching B are statistically independent.



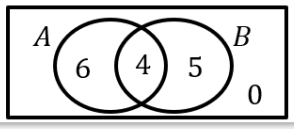
Test Your Understanding

There are three events A, B, C. The events A and B are mutually exclusive.

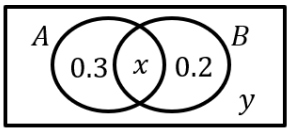
a) Draw a Venn diagram which represents this information.

b) If $P(A) = 0.1$ and $P(B) = 0.6$, determine $P(neither\ A\ nor\ B)$

The Venn diagram shows the number of people who like each of two different colours. Determine if A and B are independent.



The Venn diagram shows the probability of each event. Given that A and B are independent, determine the possible values of x.



Textbook Exercise 5C pg 77