Set Terminology

A **set** is a collection of distinct objects called **elements**

Set Language:

Listing Set: all elements of the set are listed e.g. $A = \{1, 3, 5\}$

Describing Set: a description of the elements is used
e.g. $A = \{\text{first three odd numbers}\}$

Equal Sets: contain exactly the same elements e.g. $B = \{5, 3, 1\}$,
A and B are equal sets

Empty Set: set with no elements, also known as the **null** set

Universal Set: set that contains every possible element

Subset: set that is contained within another set e.g. $C = \{5\}$ would be a subset of both A and B

Intersection: elements that sets have in common e.g. $D = \{2, 3, 4\}$ the intersection of A and D would be $\{3\}$, 3 is in A **and** B

Union: elements contained in all of the sets e.g. the union of A and D would be $\{1,2,3,4,5\}$, these elements are in A **or** B

Complement: elements of a universal set that are **not** in the set
e.g. if the universal set is the first six integers, then the complement of A would be $\{2,4,6\}$

Set Notation:

$\varnothing$ or $\{\ \}$: the empty set

$\in$: is an element of e.g. $3 \in A$

$|\ |$ or $n(\ )$: the number of elements in a set e.g. $|A| = 3$

$\subset$: is a subset of e.g. $C \subset A$, $C \subset B$, $B \subseteq A$, $\varnothing \subset A$

$\cap$: intersection e.g. $A \cap D = \{3\}$, $C \cap D = \varnothing$

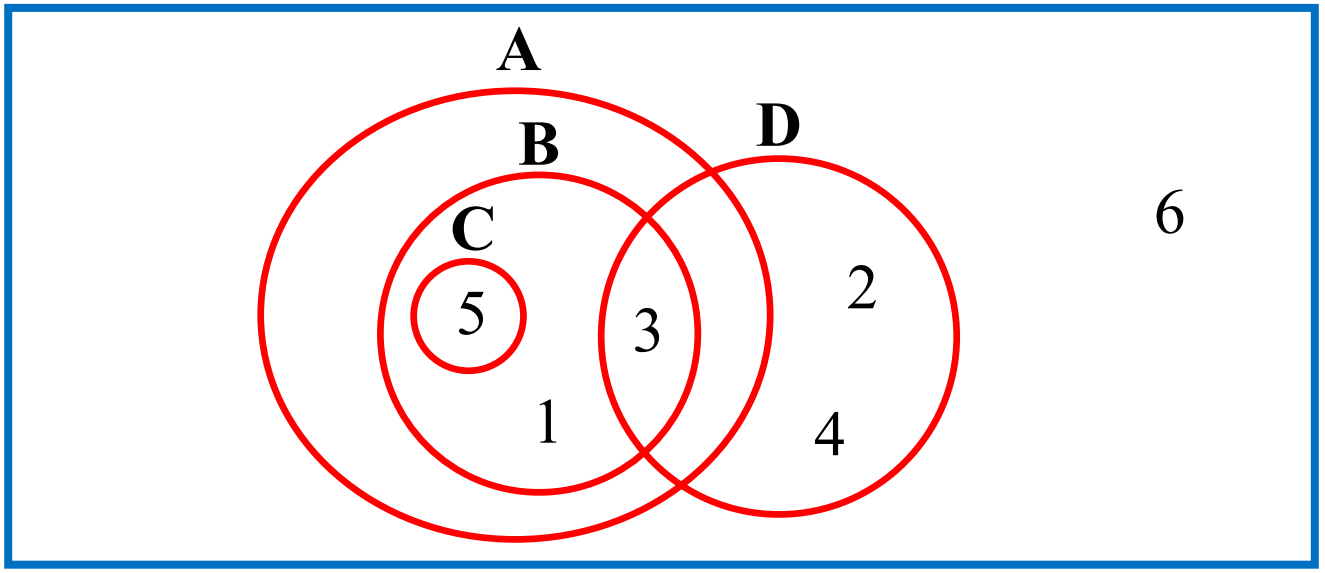
$\cup$: union e.g. $A \cup D = \{1,2,3,4,5\}$

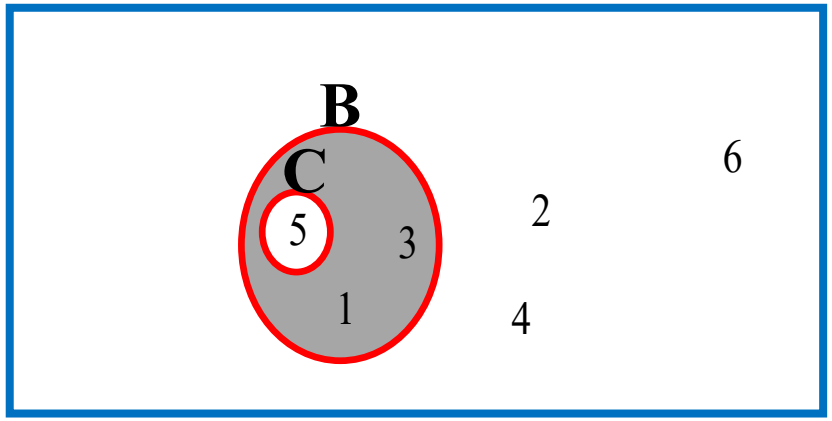
$\overline{A}$ $\left(\text{or } A' \text{ or } A^c\right)$: complement of e.g. $\overline{A} = \{2,4,6\}$

Venn Diagrams

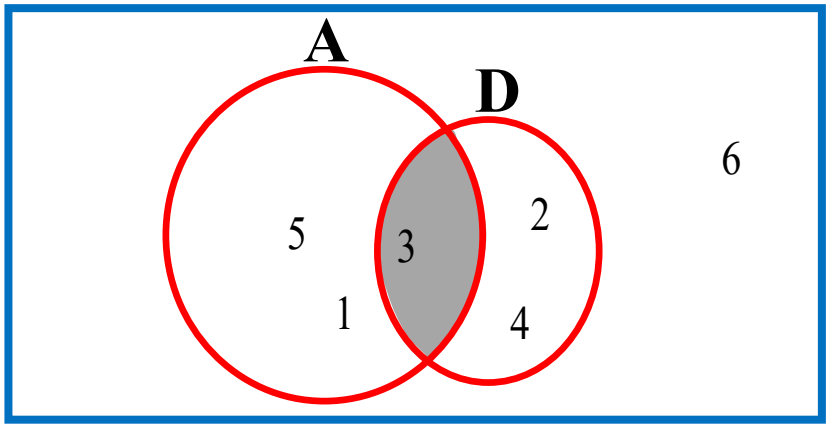
A visual (or geometrical) representation of sets

The universal set is represented by a rectangle, and all other sets are contained within the rectangle

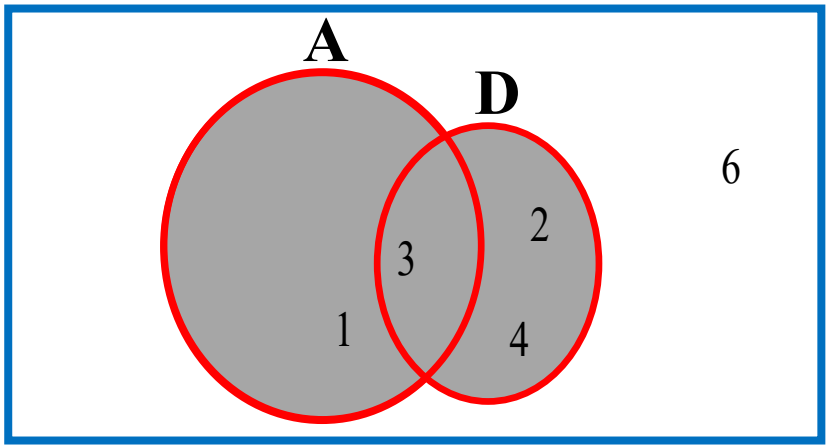




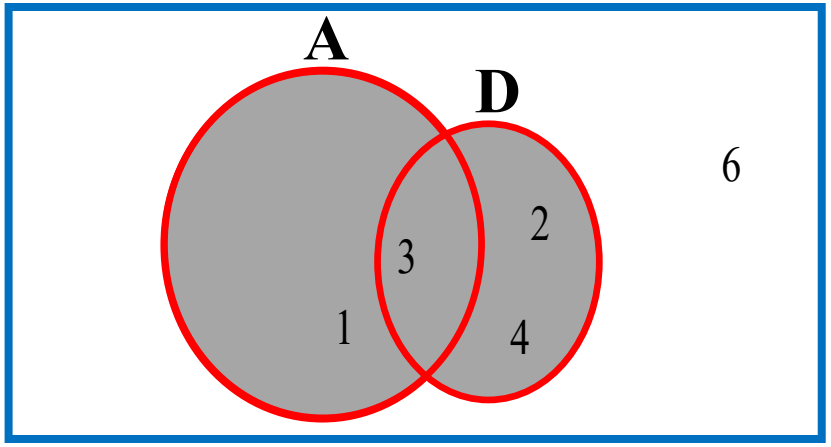
subset $C \subset B$



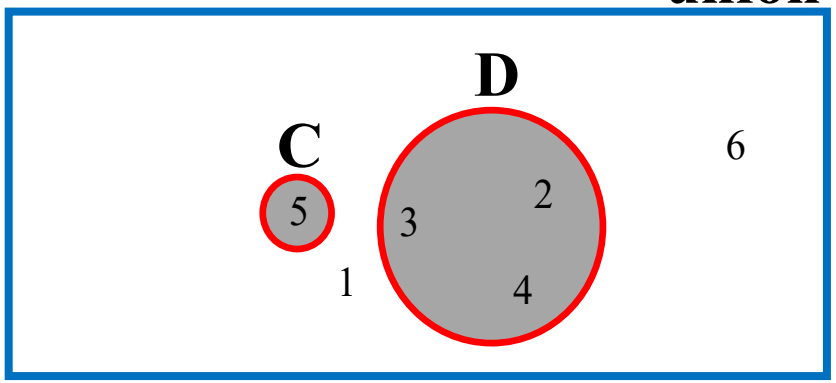
intersection $A \cap D$



union $A \cup D$



union $A \cup D$



disjoint sets (mutually exclusive)

Venn Diagrams & Counting

When using Venn diagrams to solve probability problems, we are more interested in counting the number of elements in a set, rather than the actual elements themselves

counting rule for sets

$$|A \cup B| = |A| + |B| - |A \cap B|$$

e.g. 2020 HSC Question 14

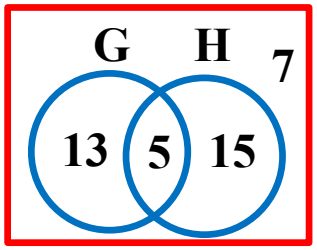
History and Geography are two of the subjects students may decide to study. For a group of 40 students, the following is known.

- 7 students study neither History nor Geography
- 20 students study History
- 18 students study Geography

a) A student is chosen at random. By using a Venn diagram, or otherwise, find the probability that the student studies both History and Geography

calculate missing info

$$|G \cup H| = |G| + |H| - |G \cap H|$$
$$33 = 18 + 20 - |G \cap H|$$
$$|G \cap H| = 5$$



$$P(G \cap H) = \frac{5}{40}$$
$$= \frac{1}{8}$$

b) A student is chosen at random. Given that he student studies Geography, what is the probability that the students does NOT study History?

$$\text{P(Geography student doesn't study History)} = \frac{13}{18}$$

c) Two different students are chosen at random, one after the other. What is the probability that the first student studies History and the second student does NOT study History?

$$P(H\overline{H}) = \frac{20}{40} \times \frac{20}{39}$$

$$= \frac{10}{39}$$

Exercise 12C; 3, 4acfh, 5, 7c, 8, 9bdf, 10aceg, 14, 16ac, 17, 18

Exercise 12D; 2, 4, 6ac, 8, 9, 11, 12, 13