Sets

We talk about sets in everyday life. *Example: A set of golf clubs, a set of tires etc.*

Def'n₁: A **set** is a group of distinct objects.

Def'n₂: Each item in a set is called an **ELEMENT aka MEMBER** of the set.
Example: A 4 iron is an element in a set of golf clubs.

We use the brackets { } to represent a set. The elements of the set are listed inside the brackets. We name sets with a CAPITAL letter.

Ex₁. The set of integers between 3 & 8: $B = \{4, 5, 6, 7\}$

The set of words used to describe the sides of a coin: $C = \{\text{head}, \text{tail}\}$

Def'n₃: If A is any set, then n(A) represents the number of elements in the set A. The answer to n(A) is called the **CARDINALITY** of set A.

Ex₂. From Ex₁ above, $n(B) = 4$ $n(C) = 2$

A **SUBSET** is a partial aka smaller set of the original set. If F = {4, 6}, than F is a subset of B. We write $F \subseteq B$.

A set with no elements in it is called an **EMPTY SET**. (or null set)

Ex₃. The set of integers, T, between 2 and 3. $T = \{ \}$ OR $T = 0$

The **UNIVERSAL SET, S** is the original set aka the complete group of items.

Ex₄. The 'universe' for the set of days of the week is, $S = \{Su, M, T, W, Th, F, Sa\}$.

Recall: If A is a subset of S (the universe), then A' (read A prime) is called the complement of A. A' is also a subset of S, and it contains all of the elements in S that are not in A.

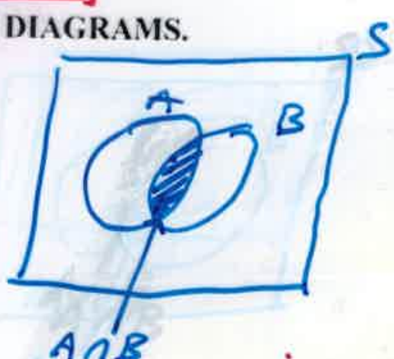
For any set A,

$$\boxed{n(A) + n(A') = n(S)}$$

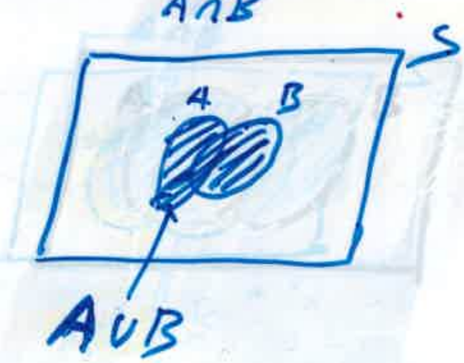
To show the relationship between sets we often use **VENN DIAGRAMS**.

Def'n₄: If A and B are 2 sets, then:

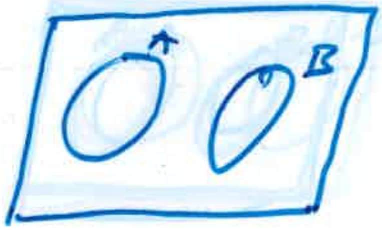
1) A ∩ B (the intersection of A and B)
Read "A intersect B." is the set of all elements common to both A and B.



2) A ∪ B (the union of A and B)
Read "A union B." is the set of all elements that belong in both A and B combined.



3) If $A \cap B = \{\ \}$ (the EMPTY or NULL set), then $n(A \cap B) = 0$ and we call A and B **DISJOINT** sets.



Ex$_6$. If A = {1, 2, 3, 4, 5, 6, 7} and B = {3, 5, 7, 9, 11} find:

a) $A \cap B = \{1, 2, 3, 4, 5, 6, 7\} \cap \{3, 5, 7, 9, 11\}$
$= \{3, 5, 7\}$

b) $A \cup B = \{1, 2, 3, 4, 5, 6, 7\} \cup \{3, 5, 7, 9, 11\}$
$= \{1, 2, 3, 4, 5, 6, 7, 9, 11\}$

Note$_1$: elements only appear once when written as a set.

Additive Principle for 2 Sets aka Sum Rule for Sets

The number of elements in $A \cup B$ is the number in A, plus the number in B, minus the number in both ($A \cap B$).

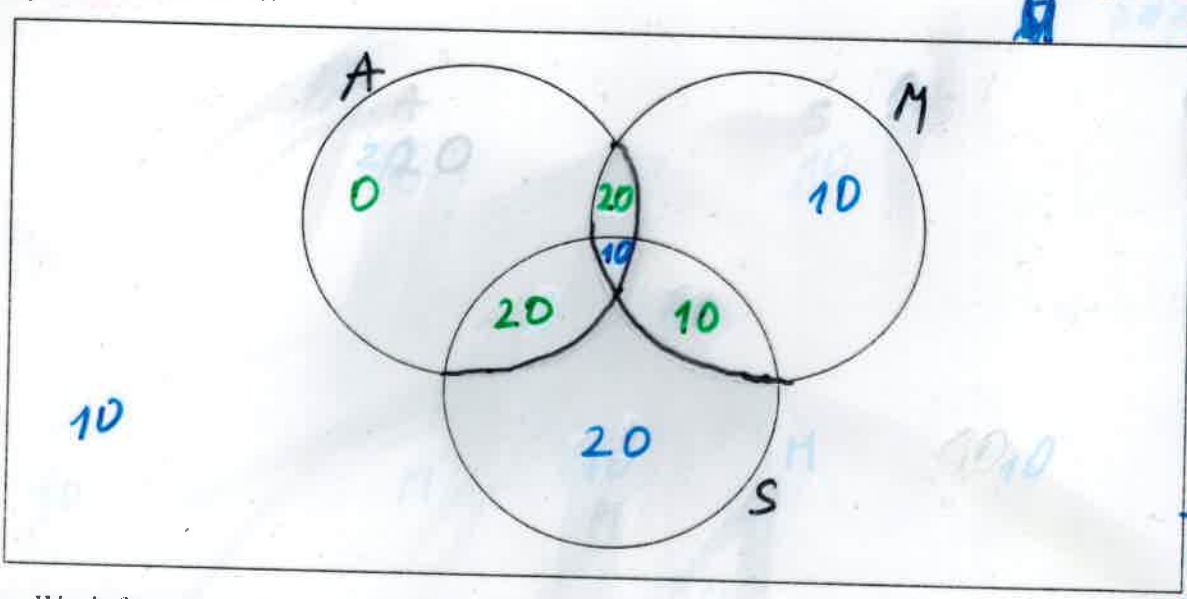
$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Ex$_7$. Set up a Venn Diagram and answer the following questions. 100 kids were asked about their favourite TV show(s).

60 people watch Sesame Street (S)
50 people watch Magic School Bus (M)
20 people watch S and M
10 people watch all three.

50 people watch Arthur (A)
30 people watch S and A
30 people watch M and A

① $n(A \cap M \cap S) = 10$
② $n(A \cap M) = 30$
$30 - 10 = 20$
$n(M \cap S) = 20$
$20 - 10 = 10$
$n(A \cap S) = 30$
$30 - 10 = 20$
③ $n(A) = 50$
$50 - (20 + 10 + 20) = 0$
$n(M) = 50$
$50 - (20 + 10 + 10)$
$= 10$
$n(S) = 60$
$60 - (20 + 10 + 10) = 20$



Note$_2$: Work from the innermost circle out (start at the bottom of the list and work up)

a) How many students watch exactly 2 shows? $20 + 20 + 10 = 50$
∴ 50 students watch exactly 2 shows.

b) *How many watch neither of the three shows?* $100 - (20 + 20 + 10 + 10 + 20 + 10)$
$= 100 - 90$
$= 10$
∴ 10 students watch neither of three shows.