Review on basic mathematical notations and concepts

1. Set: a collection of objects, enclosed by $\{\ \}$. e.g. $A = \{1, 2, 3, 4\}$.
2. $\mathbb{N}$: the set of all positive integers: $1, 2, 3, \ldots$
3. $\mathbb{Z}$: the set of all integers: $0, \pm 1, \pm 2, \ldots$
4. $\mathbb{Q}$: the set of all rational numbers: $\frac{m}{n}$
5. $\mathbb{R}$: the set of all real numbers.
6. $\mathbb{C}$: the set of all complex numbers.
7. $a \in A$: object "a" belongs to set "A", e.g. $1 \in \mathbb{N}$, $\pi \in \mathbb{R}$.
8. $a \notin A$: object "a" does not belong to set "A", e.g. $-1 \notin \mathbb{N}$, $\pi \notin \mathbb{Q}$.
9. $\{a \in A : \text{statements}\}$: the set collecting all those objects a (from the set A) satisfying all the statements.
10. $A \subseteq B$: A is a subset of B, meaning that every object of A can be found in B.
11. $A = B$: both $A \subseteq B$ and $B \subseteq A$, i.e. containing the same objects.
    (multiple objects count once, so $\{1, 1, 1, 1, 2\} = \{1, 2\}$.)
12. $A \cup B$ (A union B): the set collecting objects belonging to either A or B or both.
13. $A \cap B$ (A intersect B): the set collecting objects belonging to both A and B.
14. $A \setminus B$ (A complement B): the set collecting objects belonging to A, but not belonging to B.
15. ϕ: empty set, containing no object.
16. $(a_1, \ldots, a_n)$: ordered n-tuple, a collection of n objects $a_1, \ldots, a_n$ with ordering specified as listed. So $(a_1, a_2) \neq (a_2, a_1)$ if $a_1 \neq a_2$.
17. associative laws: $a + (b + c) = (a + b) + c, \quad a \times (b \times c) = (a \times b) \times c$
    commutative laws: $a + b = b + a, \quad a \times b = b \times a$
    distributive law: $a \times (b + c) = (a \times b) + (a \times c)$
18. $\forall$: For all, for every.
19. $\exists$: Exists at least one.
20. s.t.: such that
21. $a := b$: a is defined to be b.
22. $p \Rightarrow q$ (p implies q): Claiming the statement: if p is correct, q must also be correct.
23. $p \Leftarrow q$ (q implies p): Claiming the statement: if q is correct, p must also be correct.
24. $p \Leftrightarrow q$ (p if, and only if, q, abbreviated as "p iff q"): Means both $p \Rightarrow q$ and $q \Rightarrow p$. Sometimes will say "p is equivalent to q" or "p, q are equivalent".