Relations and Functions

1. **Ordered Pair**: A pair of elements grouped together in a particular order, typically written as (a, b).
2. **Cartesian Product**: For two sets A and B, the Cartesian product $A \times B$ is the set of all ordered pairs (a, b) where $a \in A$ and $b \in B$. In symbols, $A \times B = \{(a, b) : a \in A, b \in B\}$.
3. **Relation**: A relation R from a set A to a set B is a subset of the Cartesian product $A \times B$. It is a way of describing a relationship between the first element a and the second element b of the ordered pairs in $A \times B$.
4. **Domain of a Relation**: The set of all first elements of the ordered pairs in a relation R.
5. **Range of a Relation**: The set of all second elements of the ordered pairs in a relation R.
6. **Codomain**: The set B in a relation R from set A to set B, which contains all possible second elements.
7. **Function**: A function f from a set A to a set B is a specific type of relation where every element x of set A has one and only one image y in set B. It is denoted as $f : A \to B$, where $f(x) = y$.
8. **Identity Function**: A function $f : R \to R$ defined by $f(x) = x$ for each $x \in R$.
9. **Constant Function**: A function $f : R \to R$ defined by $f(x) = c$ for each $x \in R$, where c is a constant.
10. **Polynomial Function**: A function $f : R \to R$ defined by $f(x) = a_0 + a_1x + a_2x^2 + \cdots + a_nx^n$, where n is a non-negative integer and $a_0, a_1, \ldots, a_n$ are real numbers.
11. **Real Function**: A function that has the set of real numbers or one of its subsets both as its domain and as its range.
12. **Algebra of Functions**:
    - **Addition**: $(f + g)(x) = f(x) + g(x)$
    - **Subtraction**: $(f - g)(x) = f(x) - g(x)$
    - **Multiplication**: $(fg)(x) = f(x)g(x)$
    - **Scalar Multiplication**: $(kf)(x) = k(f(x))$, where k is a real number
    - **Division**: $(\frac{f}{g})(x) = \frac{f(x)}{g(x)}$, provided $g(x) \neq 0$.