Summary of Basic Set Theory * Page 1

A few examples of the common *numeric* sets in Mathematics are below:
Naturals, Wholes, Integers, Rationals, Irrationals, Reals…
When dealing with sets, they usually are denoted using **capital letters**.

A set is a group of objects or elements containing a common attribute.
Elements can be numbers, letters, symbols, concepts, **objects**, etc…
When dealing with sets as described above, it is common to use { }.

Note: Be able to provide adequate definitions **and** examples for below:
http://www.mathwords.com/ Do **all** dictionaries give definitions **&** examples?

1. There are two fundamental sizes for sets which are: **Finite** and **Infinite**

Finite refers to a set of *countable* elements which might be small or large but can at least can be counted in a physical or orderly manner thus ends.

Infinite set refers to a set of *non-countable* elements which are too large to be actually countable in a physical or orderly manner thus non-ending.

2. There are two basic operations on sets are **Union** and **Intersection**:

Union means to join together the elements of two sets, however, elements are not to be duplicated or repeated in the combined or total set(s).
Example of Union: A = { 1,2,3,4) B = { 3,4,5,6 } AUB = { 1,2,3,4,5,6 }

Intersection means to determine the common elements shared by two or more sets however do not duplicate or repeat in overlapping set(s).
Example of Intersection: A = { 1,2,3,4 } B = [3,4,5,6 } A∩B = { 3,4 }

3. Two special sets arise from Set Theory (*Operations*): **Universe** and **Null Sets.**

The **Universe Set** can be somewhat confusing so let's take a closer look at Universe:
Universe {**U**} can be finite to infinite and always contains all elements to be considered.
*Examples***:** {0,1,2,3,4,5,6,7,8,9}, Double Digits, Evens, Odds, Naturals, Integers, Reals…
The **Null Set** is rather simple because it contains nothing, not even 0. Null Symbol = Ø
When dealing with sets, it is important at the beginning to declare: The Universe Set.

4. Two more special sets arise from Universe and Null Sets called ***Complements***.
Example: U = {1,2,3,4,5,6,7,8} X = {1,2,3,4} Y = {5,6,7,8} X & Y *contain all* in **U**
thus X & Y are *complements***.** ***Criteria:*** X**U**Y={1,2,3,4,5,6,7,8}=**U** **&** X∩Y=Null=Ø
The ***Prime Symbol*** is used to denote complements: X & X**'** = Y Y & Y**'** = X

5. Two more special types of sets arise from Set Theory called **Subset** and **Superset**.

Subset is a smaller set which is part of another set **and** not equal **but** contained within.
Example: Subsets of P = {0,1,2,3,4,5,6,7,8,9} **Q** = {2, 4, 6, 8} **R** = {1, 3, 5} **S** = {1}
Another example of Subset with larger sets: The Naturals are a subset of Integers.

Superset is a larger set which is but more specific is a set that contains another set.
Example of Supersets: The Reals are a Superset of Integers { …,-2, -1, 0, +1, +2,… }
Another example is: The Integers are a Superset of Wholes { 0, 1, 2, 3… } **Ws ≠ Ns**

Subsets are smaller sets which are part of others **and** not equal **but** contained within.
Example: Subsets of A = {Letters of Alphabet} **V** = {Vowels} **C** = {Consonants}
Another example of Subset with larger sets: The Evens & Odds are subsets of Naturals.

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6. Sets must be considered in two basic and common ways: **Equal** & **Non-equal**

Equal sets are collection of objects that must have an equal amount of objects (elements) **however** they do not have to have same order.
Examples: { a, b, c } = { c, a, b } { @, #, &, % } = { &, %, @, # }

Non-equal sets are collection of objects that do not have equal amounts of objects (elements) and again they do not have to have same order.
Examples: { a, b, c } ≠ { a, b } { @, #, &, % } ≠ { &, %, @, #, $ }

7. Subsets may be thought of as similar **yet** different types: **Proper** & **Improper**

Proper subsets are usually thought of as *smaller sets* than an initial set or **U** set *however* Proper subsets must be *contained within* the initial set or U set.
Examples: Alphabet = { a, b, c, d… } SDs = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
Evens = { 0, 2, 4, 6, 8, 10, 12 … } Odds = { 1,3,5,7,9,11,13, … }
Challenge: Can you describe these examples using specific descriptive words?
The **Null Set** is a *special case* of Proper Subsets **but** must be considered nonetheless.

Improper subsets are often times thought of as *equal sets* to an initial set or U set but also *critical* is Improper subsets must be *contained within* the initial set or **U** set.
Examples: { Naturals } are an improper subset of { Wholes } equal to **&** contained
+Odds are *Improper* to Integers Naturals are *Improper* to Reals
Challenge: Consider the concept of **Infinite** sets and discuss/explain above examples.
The **Universe** is a *special case* of Improper Subsets **and** must be considered as such.

8. The number of subsets (Proper & Improper) can be found with a simple equation.
Total number of Subsets to any finite set is equal to: **2^n n = number of elements**.
Example: U = {1,2,3,4} Subsets = **2^4** = 16 **Null**={ }, **1's**={1}, {2}, {3}, {4}
2's={1,2}, (1,3}, {1,4}, {2,3}, {2,4}, {3,4} **3's** {1,2,3} {1,3,4}, {1,2,4} {1,2,3} **4's** {1,2,3,4}
Thus subsets can be arranged in an orderly manner: 1, 4, 6, 4, 1 = 16 **Interesting…**
Challenge: Find all Subsets for {a,b,c} & { @, #, %, &, $ } and show in orderly manner.

Do you see any areas of Math ***overlapping***? Pascal's Triangle, Combinations, others…
http://betterexplained.com/ Neat site trying to help others **with simple** explanations.

Dolciani, Mary P., *Modern Introductory Analysis*, Houghton Mifflin Co., New York, NY - T. Love 1972/2012