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AN OVERVIEW ON SETS IN MATHEMATICS

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ABSTRACT

Mathematics is a comprehensive discipline that covers a wide range of ideas such as numbers, sets, relations, functions, algebra, and many more. It's a fascinating topic that's entirely dependent on logic, mathematics, fundamentals, and practice. In recent decades, students have regarded mathematics as one of the most difficult subjects in comparison to other subjects. As a result, the author chooses to create this review problem in order for students to understand the principles of sets more simply. Sets, Types of Sets, Operations of Sets, Venn diagram, Laws of Algebra of Sets, and Real-Life Examples of Sets are all covered in this article. The theory of sets is essential since the rest of mathematics is based on them. Sets are collections of items, objects, and components that have similar characteristics. People organize their books on the basis of various topics, thus sets may be utilized in real life. The authors also addressed set algebra rules such as identity laws, associative laws, and others in this article. This paper, according to the author, aids students in comprehending sets in mathematics. Mathematics also offers a wide range of career options, including lecturer, professor, finance manager, and mathematician. As a result, sets in mathematics have a bright future since they improve abilities and knowledge.

KEYWORDS: *Elements, Laws, Mathematics, Sets, Venn diagram.*

1. INTRODUCTION

Mathematics encompasses a wide range of subjects, including Sets, Relations, Geometry, Trigonometry, Graphs, and many more. The author has addressed Sets in mathematics in this article. A set is a classification of components, entities, or objects that have similar properties. People, alphabets, and numbers are examples of the kind of items that may make up a set. There are numerous instances of sets being utilized in real life, such as in the kitchen, where people maintain their kitchen clean and well-organized, with plates kept separate from other utensils such as bowls, cups, and glasses. As a result, sets are defined as related objects that are maintained apart[1], [2].

1.1 Sets:

A set is a category of components, objects, and things that have similar properties. Upper letters are used to indicate a set, which are surrounded by curly brackets {}. The elements in the sets are non-repeatable.

Figure 1: The above diagram shows collection of clothes which is an example of sets

The example of sets is shown in Figure 1 as the Collection of clothes like hat,shirt, jeans, pants etc. have common property that people wear these clothes. A set is often described in two forms which are listed below:

I. *Roster or Tabular form:* A roster form is a form in which all the elements are separated by commas and enlisted within braces {}[3]. For ex- Sets of five numbers can be written as {1, 2, 3, 4, 5}.

II. *Set-builder form:* A set-builder form is a form which describes the things of a set instead of listing the elements. For ex- the set {1, 2, 3, 4, 5, 6, 7, 8, 9} list the elements but in set-builder form, it can be written as {x/x is a counting no. less than 10}.

1.2 Categories of sets:

- *Empty Set:* An Empty set is a set that doesn't involve any elements. Also known as null or void sets and it is denoted by ϕ. For ex- If the set is $\{x € R: X^2 = -2\}$ then the result is empty.
- *Singleton Set:* Singleton set can be defined as a set which involves only one element. The set of the first English letter can be written as {a} which is an example of Singleton set[4].
- *Finite Set:* Afinite set is a set which is either null, zero or anyone can count its elements. For ex- A set of prime numbers from 2 to 50.
- *Infinite Set:* An Infinite set can be defined as a set in which elements cannot be counted. For ex- A set of whole numbers.
- *Equivalent Sets:* Two sets can be equivalent if their processing numbers are same in both sets i.e. m (a) = m (b).

- *Equal Sets:* Two sets can be equal if every element of P is an element of Q and vice-versa. For ex- Two sets such that P={10, 11, 15} and Q={15,11,10} then P=Q as Q contain every elements of P.
- *Subset:* A set is said to be subset of another set if each element of that particular set are present in another set. Each set is always is a subset for itself. An empty set is considered as a subset for each existing set. For example, if A={1, 2} and B ={4,1,5,2,3} then here A is subset of B as every element of A is present in B. It is denoted as P⊆ Q.
- *Universal Set:* Universal set can be defined as a set which involves all the possible values related to given context. For ex- R= {5, 7}, S= {9, 0} and T= {3, 4, 6} then A as a Universal set written as {0, 3, 4, 5, 6, 7, 9}.
- *Power Set:*Power set for any given set is a collection of all subsets of any given set and denoted by P(X) where X= any set. For example power set of { 12,13,11} will be {{11},{12},{13},{11,12},{11,13},{12,13},{11,12,13},∅}.

1.3 Venn Diagrams:

A Venn diagram is a diagram in which all the possible values is represented within a rectangle and its subset is represented by circles within the given rectangle[5]. For ex- Suppose a set B is a subset of a set A then the circle representing A is drawn inside the circle representing B as shown in Figure 2[6].

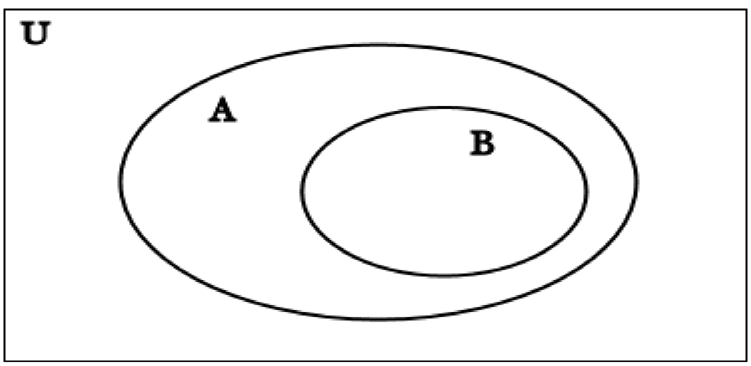

Figure 2: The above diagram shows the representation of Venn Diagram

1.4 Operations on Sets:

In this part, the author has discussed about some operations on sets which are stated below:

1. *Union of sets:* Union of sets can be defined as the set of all possible values which either belongs to two different sets or both sets. Sets union can be represented by '∪' symbols. Figure 3 shows the example of combination of two sets A and B.

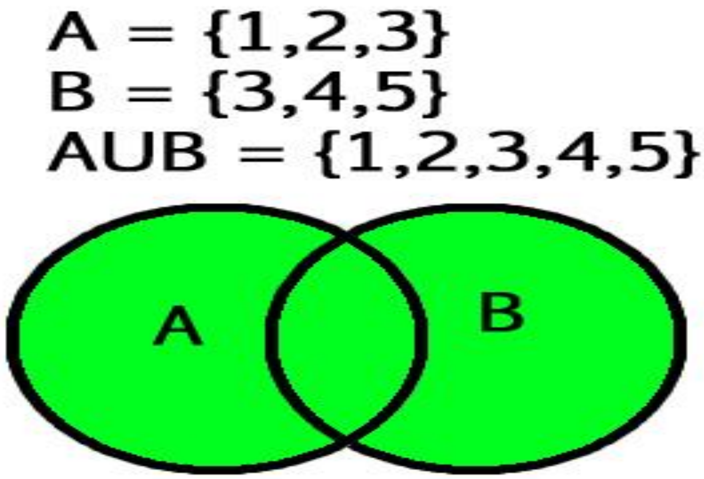

Figure 3: The above diagram shows the Fusion of two sets A and B

2. *Intersection of sets:* For any two sets, let's say P & Q. The intersection of P and Q is the set of those valuesthat are common in P and Q. It can be represented as '∩' symbol. For ex- If we have two sets such as A and B & A= {1,3,4,5) and B= {2,1,4} then A ∩ B = {1,4} as 1 and 4 is common to both A and B. If any pair of set does not have anything in common then, their intersection set contains Ø as it represents null value. Figure 4 represents the Venn diagram of intersection of two sets A and B[7].

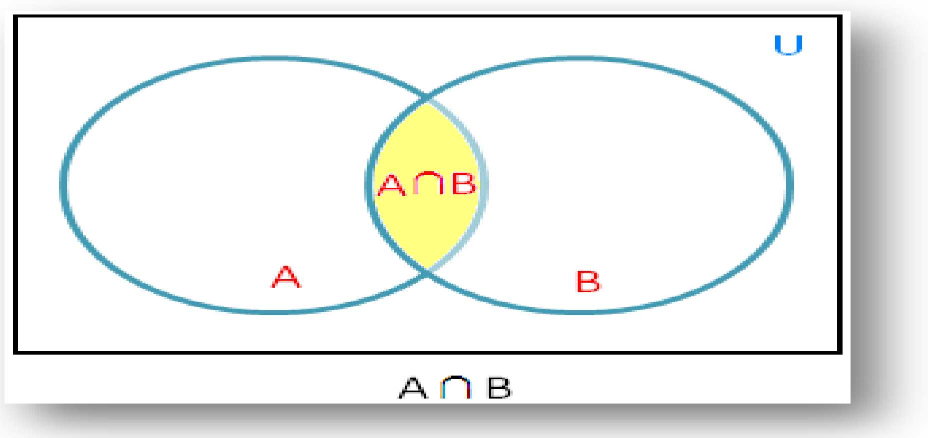

Figure 4: The above diagram shows the Venn diagram of intersection of two sets A and B

3. *Disjoint sets:* Disjoint sets for any two sets can be defined as sets which don't have any common elements. If disjoints sets have common values then they are said to be intersecting or overlapping sets. For ex- X={1,2,3,4}, Y={9,10,11}and C={1,2,3} then X and Y is calleddisjoint sets as X and Y doesn't have any mutual values& A and C are said to be overlapping sets as they have common values[8].Figure 5 represents the Venn diagram of disjoints sets X and Y.

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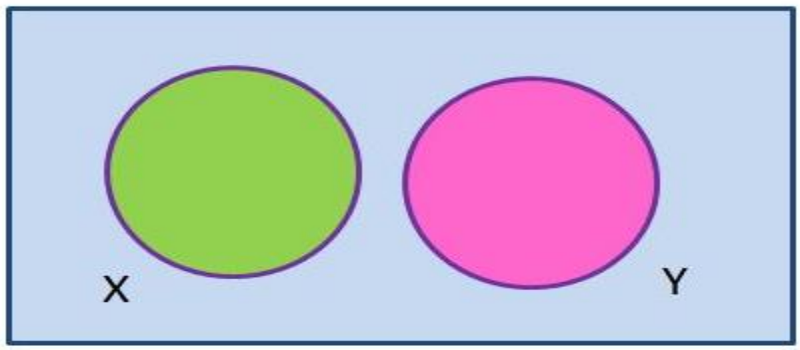

Figure 5: The above diagram shows the Venn diagram of two disjoint sets of X and Y

4. *Sets difference:* Suppose if take sets X and Y then sets difference is the removal of all the elements of X which is not involved in Y[9]. It can be written as X-Y. For ex- Suppose sets X and Y such as X= {5, 6, 7} and Y= {6} then X-Y= {5,7}. The difference of sets is represented in Figure 6.

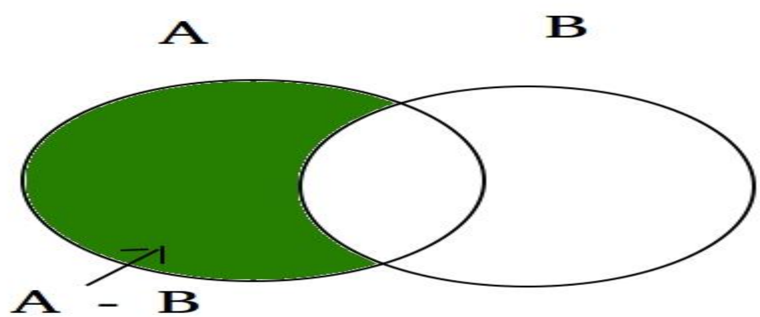

Figure 6: The above diagram shows the Venn diagram of difference in two sets

5. *Symmetric Differences:* Symmetric difference of two sets is the set of (A-B) ∩ (B-A) and It is denoted by AΔB.

6. *Complement of a set:* Sets Complement can be defined as all the values involved in A does not belongs to A’. It is denoted by X' where X is any set. Figure 7 represents the Complement of A. The coloured area is the complement of A.

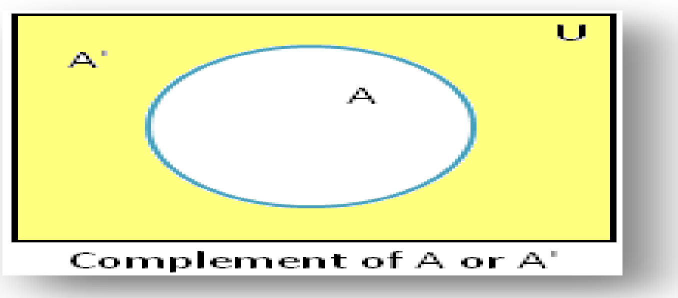

Figure 7: The above diagram shows the diagram of Complement of a set A

1.5 Laws of sets of algebra:

Table 1 represents the laws of sets of algebra.

TABLE 1: LAWS OF SETS OF ALGEBRA

Idempotent laws:	(1a) $A \cup A = A$	(1b) $A \cap A = A$
Associative laws:	(2a) $(A \cup B) \cup C = A \cup (B \cup C)$	(2b) $(A \cap B) \cap C = A \cap (B \cap C)$
Commutative laws:	(3a) $A \cup B = B \cup A$	(3b) $A \cap B = B \cap A$
Distributive laws:	(4a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$	(4b) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
Identity laws:	(5a) $A \cup \emptyset = A$	(5b) $A \cap \mathbf{U} = A$
	(6a) $A \cup \mathbf{U} = \mathbf{U}$	(6b) $A \cap \emptyset = \emptyset$
Involution laws:	(7) $(A^C)^C = A$	
Complement laws:	(8a) $A \cup A^C = \mathbf{U}$	(8b) $A \cap A^C = \emptyset$
	(9a) $\mathbf{U}^C = \emptyset$	(9b) $\emptyset^C = \mathbf{U}$
DeMorgan's laws:	(10a) $(A \cup B)^C = A^C \cap B^C$	(10b) $(A \cap B)^C = A^C \cup B^C$

1.6 Cartesian Product of sets:

Cartesian Products of two set P and Q is basically the sets of all involved pair (p, q). It is denoted as P x Q. Example if we have , if P={1,2,3} and Q={5,6} then product Cartesian of P and Q will be P x Q = {(1,5),(1,6),(2,5),(2,6),(3,5),(3,6)}. It can also be represented in set builder form as P × Q = {(p, q): p∈ P and q∈ Q}. Figure 8 represents the Cartesian product of sets.

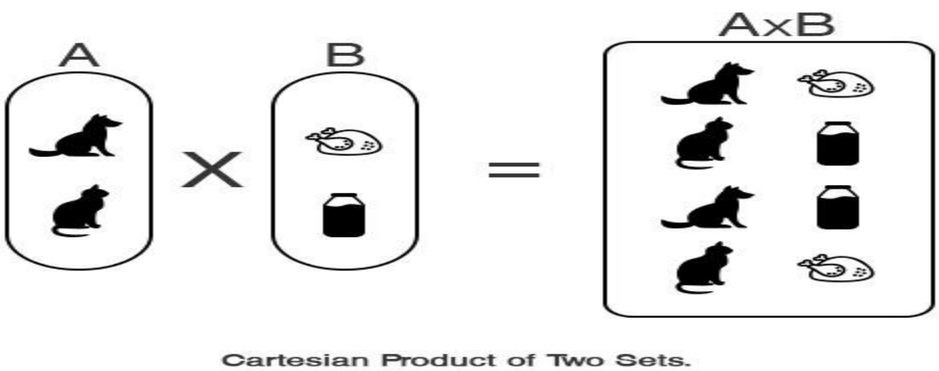

Figure 8: The above diagram shows the Cartesian products of two set

1.7 Examples of sets in real life[10]*:*

- Playlists as an example People have smart phones and laptops, and they can build playlists based on genres. As a result, a playlist is an example of a set.
- There are numerous galaxies in our universe, all of which are separated from one another by a significant distance. As a result, this is likewise a set example.
- The kitchen is maintained in order by the people, and dishes and bowls are kept separate. As a result, the kitchen is an example of a set.

2. DISCUSSION

Mathematics is a vast topic with many sub-disciplines. The majority of mathematical progress has been practical. Logic and numbers are the foundations of all mathematical ideas. There are a number of initiatives that are entirely based on mathematical ideas. In the area of mathematics, there are many career possibilities such as teacher, professor, mathematician, and finance manager.Sets, Relations, Functions, Sequence & Series (which includes arithmetic and geometric progression), Trigonometry, Exponents, Logarithms, Algebraic Equations (such as Linear equations, Polynomial equations, and Cubic equations), and Algebraic Equations (such as Linear equations, Polynomial equations, and Cubic equations) are some of the topics covered in mathematics. Sets, types of sets, operations of sets, rules of algebra of sets, and real-life examples are covered in this review article. This review article was written by the author in order for students or others to get a better knowledge of sets in mathematics. As a result, the future of sets in mathematics looks bright, as people's understanding grows.

3. CONCLUSION

The theory of sets is significant because it underpins the rest of mathematics, and sets offer a variety of applications to the rest of mathematics. Sets are defined as a group of objects or components that have a similar characteristic. In recent decades, students have regarded mathematics as one of the most difficult subjects in comparison to other subjects. As a result, the author decided to create this review problem in order for students to understand the principles of sets more simply. Sets, Types of Sets, Operations of Sets, Venn Diagram, Laws of Algebra of Sets, and Real-Life Examples of Sets are all covered in this article. Because mathematics is a discipline based only on fundamentals and formulas, anybody who understands the fundamental ideas and formulae may be a competent mathematician. When it comes to employment possibilities, mathematics is a popular choice since there are many options such as finance manager, professor, teacher, and many more. As a result, the future of mathematical ideas is bright for individuals who want to improve their abilities and careers.

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