

Venn Diagram

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Venn diagrams are visual tools used to show relationships between different sets. They use overlapping circles to represent how sets intersect, share elements, or stay separate. These diagrams help categorize items, making it easier to understand similarities and differences.

In mathematics, Venn diagrams are placed inside a rectangle, which represents the **universal set**—a set that contains all elements from all the sets shown. This visual method makes it easier to understand complex relationships between sets.



Venn Diagrams are used to represent the groups of data in circles, if the circles are overlapping, some elements in the groups are common, if they are not overlapping, there is nothing common between the groups or sets of data

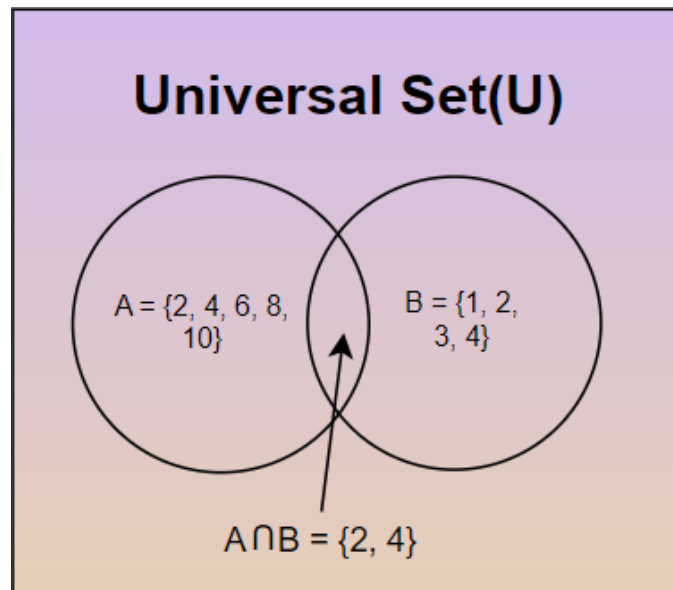
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Got It !

Venn diagrams are highly useful in solving problems of sets and other problems. They are useful in representing the data in picture form. Let's learn more about the Venn diagram through an example,

Example 1: Take a set A representing even numbers up to 10 and another set B representing natural numbers less than 5 then their interaction is represented using the Venn diagram.

Solution:



How to Draw a Venn Diagram?

The above symbols are used while drawing and showing the relationship among sets. In order to draw a Venn diagram.

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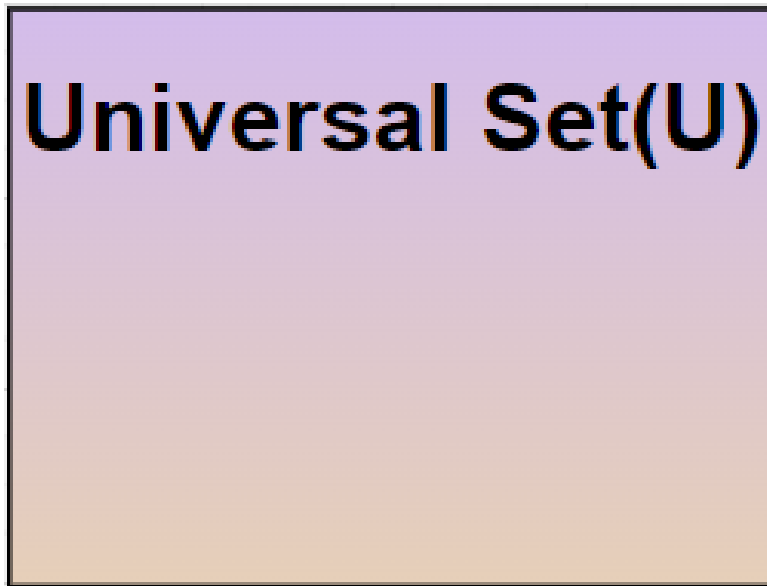
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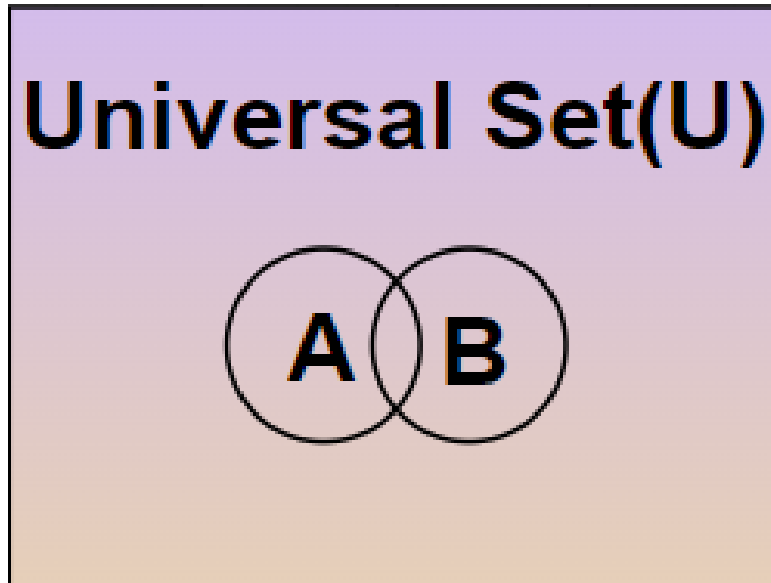
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Step 1: Start by drawing a Rectangle showing the Universal Set.

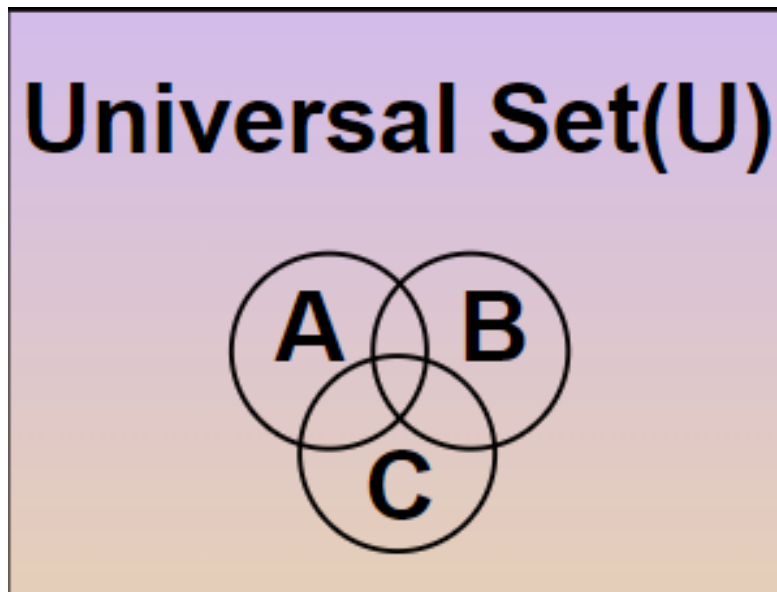


Step 2: According to the number of sets given and the relationship between/among them, draw different circles representing different Sets.



Step 3: Find the intersection or union of the set using the condition given.

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Read More: [Representation of a Set](#)

Venn Diagram for Sets Operations

There are different operations that can be done on sets in order to find the possible unknown parameter, for example, if two sets have something in common, their intersection is possible. The basic operations performed on the set are,

- [Union of Set](#)
- [Intersection of Set](#)
- [Complement of Set](#)
- [Difference of Set](#)

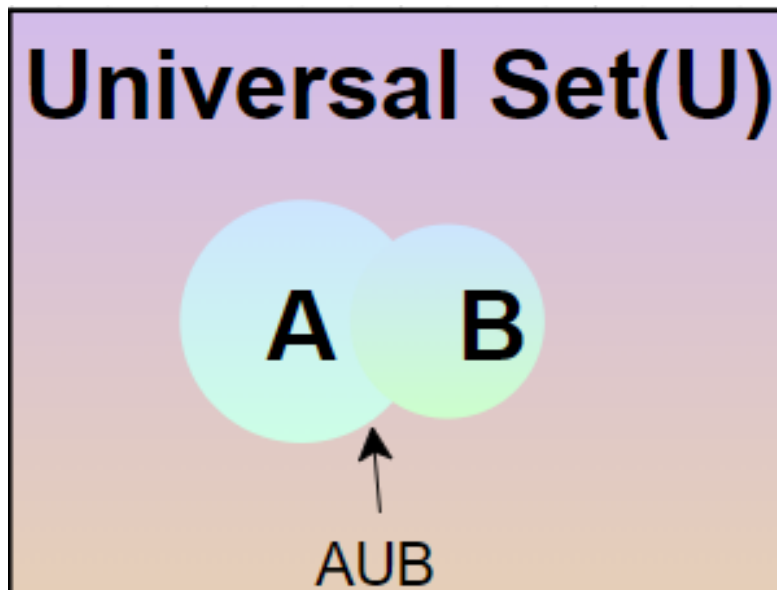
Let's look at these set operations and how they look on the Venn diagram.

Venn Diagram of Union of Sets

The Union of two or more two sets represents the data of the sets without repeating the same data more than once, it is shown with the symbol $\rightarrow U$.

$$n(A \cup B) = \{a: a \in A \text{ OR } a \in B\}$$

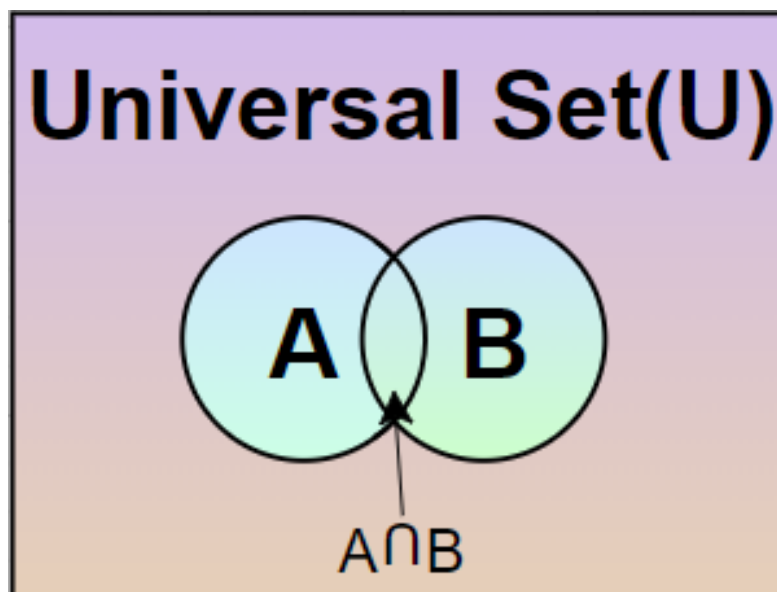
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Venn Diagram of Intersection of Sets

The intersection of two or more two sets means extracting only the amount of data that is common between/among the sets. The symbol used for the intersection $\rightarrow \cap$.

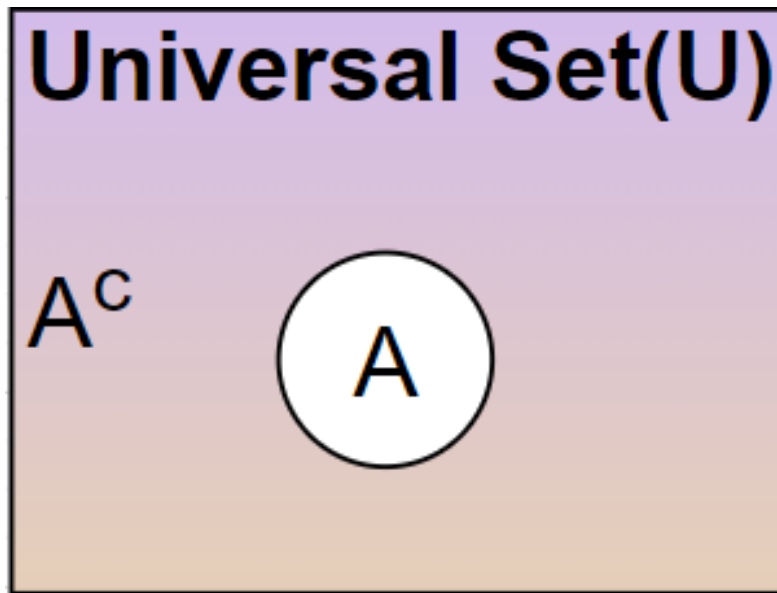
$$n(A \cap B) = \{a: a \in A \text{ and } a \in B\}$$



Venn Diagram of Complement of a Set

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$$n(A') = U - n(A)$$



Venn Diagram of Difference of Set

Suppose we take two sets, Set A and Set B then their difference is given as $A - B$. This difference represents all the values of set A which are not present in set B.

For example, if we take Set $A = \{1, 2, 3, 4, 5, 6\}$ and set $B = \{2, 4, 6, 8\}$ then $A - B = \{1, 3, 5\}$.

In the Venn diagram, we represent the $A - B$ as the area of set A which is not intersecting with set B.

Terms Related to Venn Diagram

The concept of the Venn diagram is very useful for solving a variety of problems in Mathematics and others. To understand more about it let's learn some important terms related to it.

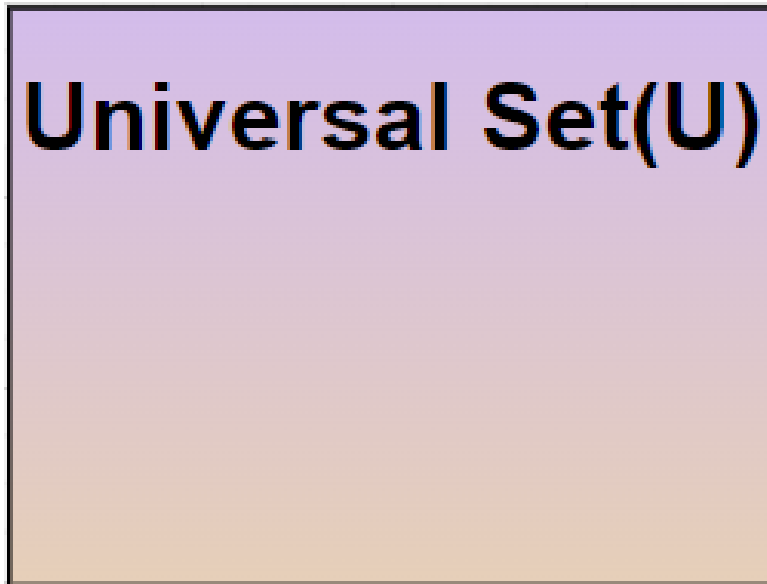
Universal Set

Universal Set is a large set that contains all the sets which we are

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then the set of all the cars in that society is the universal set as it contains the values of both the [sets](#), set A and set B in consideration.

The image representing the Universal set is discussed below,



Subset

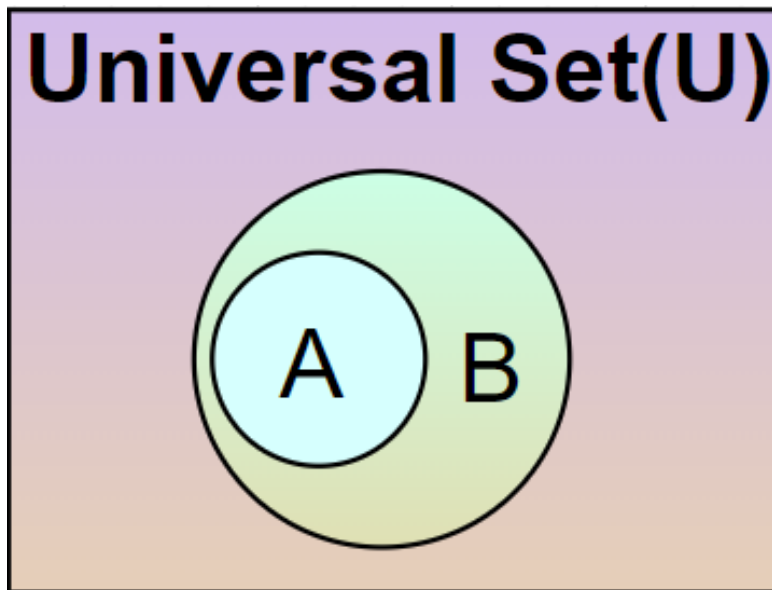
Subset is actually a set of values that is contained inside another set i.e. we can say that set B is the subset of set A if all the values of set B are contained in set A.

For example, if we take N as the set of all the [natural numbers](#) and W as the set of all [whole numbers](#) then,

- N = Set of all Natural Numbers
- W = Set of all Whole Numbers

We can say that N is a subset of W all the values of set N are contained in set W i.e., $N \subseteq W$

We use Venn diagrams to easily represent a subset of a set. The images discussing the subset of a set are given below,



Venn Diagram Symbols

In order to draw a Venn diagram, first, understand the type of symbols used in sets. **Sets can be easily represented on the Venn diagram** and the parameters are easily taken out from the diagram itself. We use various types of symbols in drawing Venn diagrams, some of the most important types of symbols used in drawing Venn diagrams are,

Venn Diagram Symbols	Name of Symbol	Description
\cup	Union Symbol	Union symbol is used for taking the union of two or more sets.
\cap	Intersection Symbol	Intersection symbol is used for taking the intersection of two or more sets.
A' or A^c	Compliment Symbol	Complement symbol is used for taking the complement of a set.

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There are various types of Venn diagrams that are widely used in Mathematics and other related fields. They are categorized based on the number of sets involved or circles involved in the Universal set.

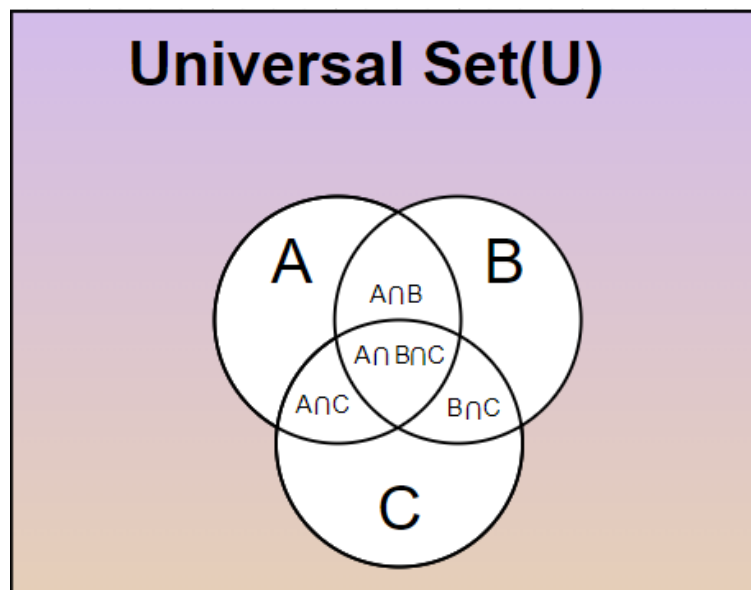
- Two-set Venn diagram
- Three-set Venn diagram
- Four-set Venn diagram
- Five-set Venn diagram

Venn Diagram for Three Sets

We can represent three sets easily using the Venn Diagram. Their representation is done by three overlapping circles. Suppose we take three sets of Set A of the people who play cricket. Set B of the people who are graduates and Set C of the people who are 18 years and above of the age.

Then the Venn diagram representing the above three sets is drawn using three circles and taking their intersection wherever required.

We can represent the intersection of three sets using the Venn diagram. The below image represents the intersection of three sets.



We can find the various parameters using the above Venn diagram.

Suppose we have to find

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- No of graduates who play cricket and are at least 18 years old is given by $A \cap B \cap C$, etc.

Also Check:

- [Difference of Sets](#)
- [Equal Sets](#)

Venn Diagram Formula

We use various formulas of the set to find various parameters of the sets.

Let's take two sets, set A and set B then the various formulas of the sets are,

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

Where,

- $n(A)$ represents the number of elements in set A,
- $n(B)$ represents the number of elements in set B,
- $n(A \cup B)$ represent the number of elements in $A \cup B$, and
- $n(A \cap B)$ represent the number of elements in $A \cap B$

Similarly, for three sets, Set A, Set B, and Set C we get,

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

We can understand these formulas with the help of the example discussed below,

Example: In a class of 40 students, 18 like Mathematics, 16 like Science, and 10 like both Mathematics and Science. Then find the students who like either Mathematics or Science.

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Let A be the set of students who like Mathematics and B be the set of students who like Science, then

$$n(A) = 18,$$

$$n(B) = 16, \text{ and}$$

$$n(A \cap B) = 10$$

Now to find the number of students who like either Mathematics or Science i.e. $n(A \cup B)$ we use the above formula.

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

$$\Rightarrow n(A \cup B) = 18 + 16 - 10$$

$$\Rightarrow n(A \cup B) = 24$$

Uses and Applications of Venn Diagram

Venn diagrams have various use cases such as solving various problems and representing the data in an easy-to-understand format. Various [applications of Venn Diagrams](#) are:

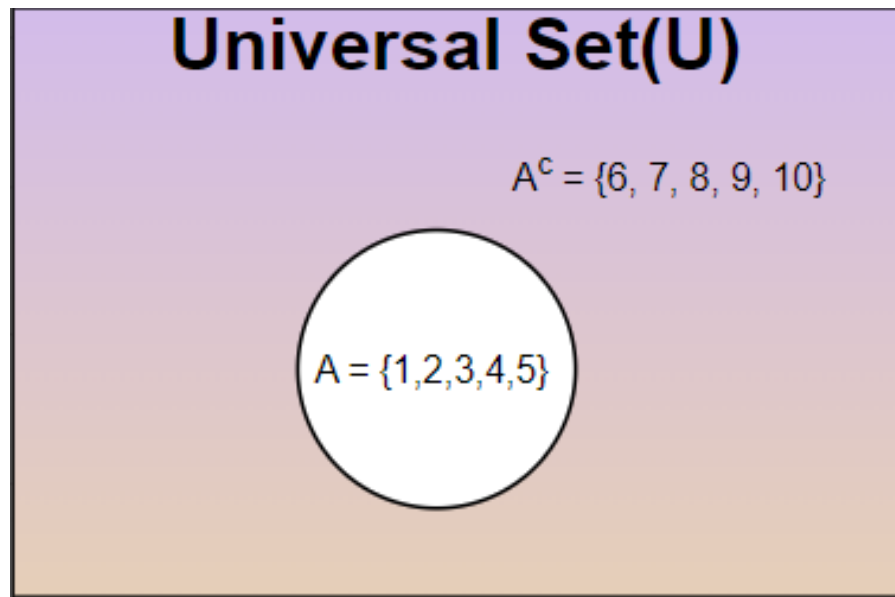
- The relation between various sets and their operations can be easily achieved using Venn diagrams.
- They are used for explaining large data sets in a very easy way.
- They are used for logic building and finding the solution to complex data problems.
- They are used to solve problems based on various analogies.
- Analysts use Venn diagrams to represent complex data in easily understandable ways, etc.

Related Article on Venn Diagram:

- [Operations on Sets](#)
- [Types Of Sets](#)
- [Set Theory Formulas](#)

Solved Example Problems on Venn Diagram

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Solution:*Venn Diagram for A'* 

Example 2: In a Group of people, 50 people either speak Hindi or English, 10 prefer speaking both Hindi and English, 20 prefer only English. How many people prefer speaking Hindi? Explain both by formula and by Venn diagram.

Solution:*According to formula,*

$$n(H \cup E) = n(H) + n(E) - n(H \cap E)$$

Both English and Hindi speakers, $n(H \cap E) = 10$ *English speakers, $n(E) = 20$* *Either Hindi or English, $n(H \cup E) = 50$*

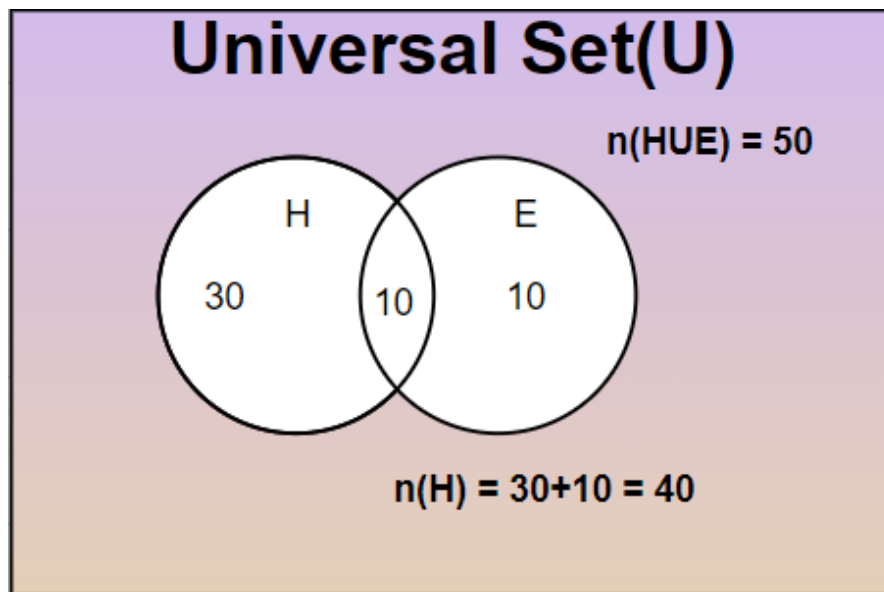
$$50 = 20 + n(H) - 10$$

$$n(H) = 50 - 10$$

$$n(H) = 40$$

From Venn Diagram,

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Example 3: In a Class, Students like to play these games- Football, Cricket, and Volleyball. 5 students Play all 3 games, 20 play Football, 30 play Volleyball, and 40 play Cricket. 10 play both cricket and volleyball, 12 play both football and cricket, 9 play both football and volleyball. How many students are present in the class?

Solution:

$$n(F \cup C \cup V) = n(F) + n(C) + n(V) - n(F \cap C) - n(F \cap V) - n(C \cap V) + n(F \cap C \cap V)$$

$$n(F \cup C \cup V) = 20 + 30 + 40 - 10 - 12 - 9 + 5$$

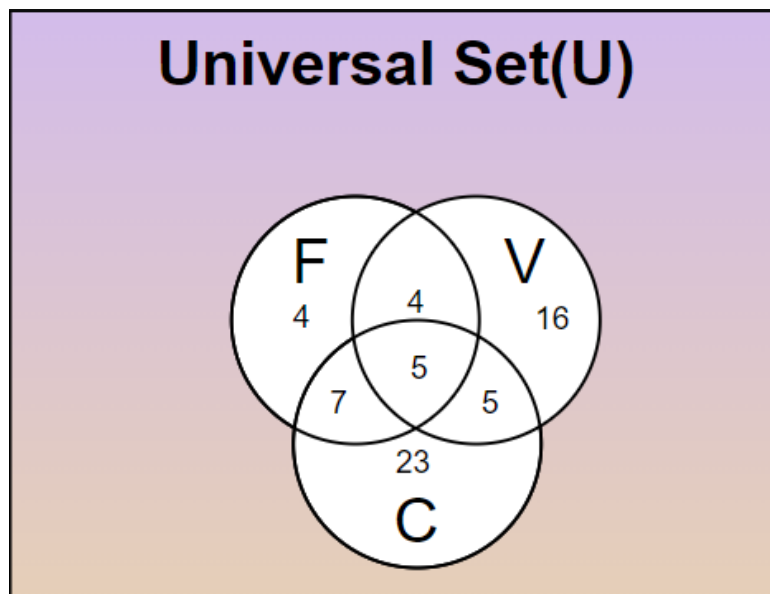
$$n(F \cup C \cup V) = 64$$

There are 64 Students in the class.

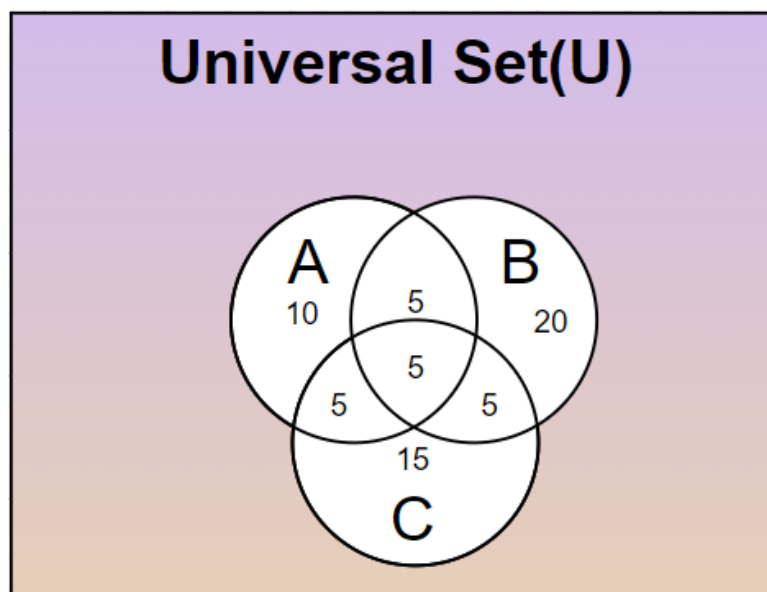
Example 4: Represent the above information with the help of a Venn diagram showing the amount of data present in each set.

Solution:

Above information should look something like this on Venn diagram,



Example 5: Below given Venn diagram has all the sufficient information required to show the data of all the sets possible. Observe the diagram carefully then answer the following.



1. What is the value of $n(A \cap B \cap C)$?
2. What is the value of $n(C)$?
3. What is the value of $n(B \cap A)$?
4. What is the value of $n(A \cup B \cup C)$?
5. What is the value of $n(B')$?

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Observing the Venn diagram, the above questions can be easily answered,

1. $n(A \cap B \cap C) = 5$

2. $n(C) = 15 + 5 + 5 + 5 = 30$

3. $n(B \cap A) = 5 + 5 = 10$

4. $n(A \cup B \cup C) = 15 + 20 + 10 + 5 + 5 + 5 + 5 = 65$

5. $n(B') = U - n(B) = 100 - (20 + 5 + 5 + 5) = 100 - 35 = 65$

➤ **Suggested Article:** [Venn Diagrams on Reasoning](#)

Venn Diagrams Practice Questions

Question 1: Consider two sets, A and B, where A represents fruits and B represents vegetables. Set A contains apples, bananas, and grapes, while set B contains carrots, lettuce, and apples. Draw a Venn diagram to represent these sets. How many items are only in the fruit category?

Question 2: In a small neighborhood, 10 households have dogs, 7 have cats, and 3 households have both dogs and cats. How many households have at least one kind of pet? Draw a Venn diagram to represent this situation.

Question 3: In a sports club, 120 members play tennis, 150 play badminton, and 50 play both tennis and badminton. How many members play either tennis or badminton? Create a Venn diagram to help you answer.

Question 4: In a class of 30 students, 18 students play basketball, 12 students play football, and 8 students play both basketball and football. How many students do not play either basketball or football?

Question 5: A survey of 100 people was conducted to find their preferences for three types of movies: Action, Comedy, and Drama. The survey results showed:

- 45 people like Action movies.

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- 30 people like both Comedy and Drama.
- 20 people like both Drama and Action.
- 10 people like all three types of movies.

How many people like exactly two types of movies?

Conclusion

Venn diagrams, created by English logician John Venn in the 1880s. Venn diagrams are a powerful tool for visualizing the relationships between different sets, making complex concepts more accessible and easier to understand. Using overlapping circles within a rectangle (the universal set), they illustrate how sets intersect, differ, and relate, with each circle representing a different set. Overlapping regions show common elements, while non-overlapping areas highlight unique element. Venn diagrams are applied across various fields for problem-solving, data presentation, and [logical reasoning](#), making them a versatile tool for educators, students, and professionals alike.

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