

# Tips, Formulae and shortcuts for Sets and Venn diagrams

By

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## Cracku Tip 1 – Sets and Venn diagrams

- Its one of the easiest topics of CAT.
- Most of the formulae in this section can be deduced logically with little effort.
- The difficult part of the problem is translating the sentences into areas of the Venn diagram.
- While solving, pay careful attention to phrases like and, or, not, only, in as these generally signify the relationship.

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## Cracku Tip 2 – Sets and Venn diagrams

- Set is defined as a collection of well-defined objects.  
Ex. Set of whole numbers
- Every object is called Element of the set.
- The number of elements in the set is called cardinal number

## Cracku Tip 3 – Sets and Venn diagrams

### Types of Sets

#### 1. Null set:

A set with zero or no elements is called Null set. It is denoted by  $\{ \}$  or  $\emptyset$ . Null set cardinal number is 0

#### 2. Singleton set:

Sets with only one element in them are called singleton sets.

Ex.  $\{2\}$ ,  $\{a\}$ ,  $\{0\}$

#### 3. Finite and Infinite set:

A set having finite number of elements is called finite set. A set having infinite or uncountable elements in it is called infinite set.

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## Cracku Tip 4 – Sets and Venn diagrams

### Types of Sets

#### 4. Universal set:

A set which contains all the elements of all the sets and all the other sets in it, is called universal set.

#### 5. Subset:

A set is said to be subset of another set if all the elements contained in it are also part of another set. Ex. If  $A = \{1,2\}$ ,  $B = \{1,2,3,4\}$  then, Set “A” is said to be subset of set B.

## Cracku Tip 5 – Sets and Venn diagrams

### Types of Sets

#### 6. Equal sets:

Two sets are said to be equal sets when they contain same elements

Ex.  $A = \{a, b, c\}$  and  $B = \{a, b, c\}$  then A and B are called equal sets.

#### 7. Disjoint sets:

When two sets have no elements in common then the two sets are called disjoint sets

Ex.  $A = \{1, 2, 3\}$  and  $B = \{6, 8, 9\}$  then A and B are disjoint sets.

# Cracku Tip 6 – Sets and Venn diagrams

## Types of Sets

### 8. Power set:

- A power set is defined as the collection of all the subsets of a set and is denoted by  $P(A)$
- If  $A = \{a, b\}$  then  $P(A) = \{ \{ \}, \{a\}, \{b\}, \{a, b\} \}$
- For a set having  $n$  elements, the number of subsets are  $2^n$

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## Cracku Tip 7 – Sets and Venn diagrams

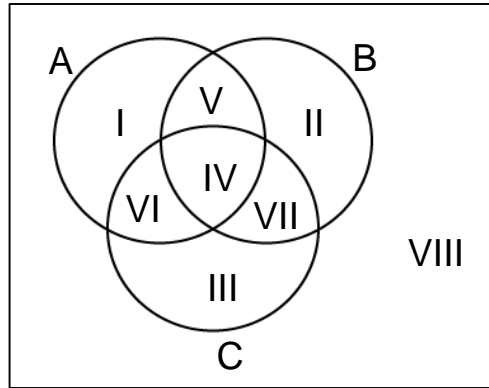
Properties of Sets:

- The null set is a subset of all sets
- Every set is subset of itself
- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
- $A \cup \emptyset = A$



## Cracku Tip 8 – Sets and Venn diagrams

Venn diagrams: A Venn diagram is a figure to represent various sets and their relationship.



I, II, III are the elements in only A, only B and only C respectively

IV – Elements which are in all of A, B and C.

V - Elements which are in A and B but not in C.

VI – Elements which are in A and C but not in B.

VII – Elements which are in B and C but not in A.

VIII – Elements which are not in either A or B or C.

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## Cracku Tip 9 – Sets and Venn diagrams

Union of sets is defined as the collection of elements either in A or B or both. It is represented by symbol “U”. Intersection of set is the collection of elements which are in both A and B.

- Let there are two sets A and B then,

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

- If there are 3 sets A, B and C then,

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

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## Cracku Tip 10 – Sets and Venn diagrams

To maximize overlap,

- Union should be as small as possible
- Calculate the surplus =  $n(A) + n(B) + n(C) - n(A \cup B \cup C)$
- This can be attributed to  $n(A \cap B \cap C')$ ,  $n(A \cap B' \cap C)$ ,  $n(A' \cap B \cap C)$ ,  $n(A \cap B \cap C)$ .
- To maximize the overlap, set the other three terms to zero.

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## Cracku Tip 11 – Sets and Venn diagrams

To minimize overlap,

- Union should be as large as possible
- Calculate the surplus =  $n(A) + n(B) + n(C) - n(A \cup B \cup C)$
- This can be attributed to  $n(A \cap B \cap C')$ ,  $n(A \cap B' \cap C)$ ,  $n(A' \cap B \cap C)$ ,  $n(A \cap B \cap C)$ .
- To minimize the overlap, set the other three terms to maximum possible.

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## Cracku Tip 12 – Sets and Venn diagrams

Some other important properties

- $A'$  is called complement of set  $A$ , or  $A' = U - A$
- $n(A - B) = n(A) - n(A \cap B)$
- $A - B = A \cap B'$
- $B - A = A' \cap B$
- $(A - B) \cup B = A \cup B$

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