GIRLS' HIGH SCHOOL AND COLLEGE,PRAYAGRAJ

2020 – 2021

CLASS - 11 B & C

MATHEMATICS

WORKSHEET NO. 1

CHAPTER: SETS AND FUNCTION

Note: Parents are expected to ensure that the student spends two days to read and understand the topic according to the book or the website referred and thereafter answer the questions.

Book : ISc mathematics for class 11 by OP Malhotra

Website: www.khanacademy.org ,www.topperlearning.com or any other relevant website.

SETS

Definition of Set

A well-defined collection of objects, is called a set. Sets are usually denoted bythe capital letters A, B, C, X, Y, Z etc. The elements of a set are represented by small letters a, b, c, x, y, z etc.

If a is an element of a set A, then we say that a belongs to A. The word belongs to' is denoted by the Greek symbol ∈ (epsilon).Thus, in notation form, a belongs to set A is written as $a \in A$ and a does notbelong to set A is written as $a \notin A$e.g. (i) If A={1, 2, 3, 4, 5}, then $3 \in A$ but $6 \notin A$,

(ii) If P being the set of perfect square numbers, then $36 \in P$ but $5 \notin P$.

Note : The braces { } are used to enclose the members of a set.

Representation of a set

A set can be represented in

1. Words or Statement form
2. Roster or Tabulation method
3. Rule method or set builder method

1. **Statement Form:** well defined description of the elements of the set is given and the same are enclosed in curly brackets .

   Ex. The set of odd numbers less than 7 is written as { odd numbers less than 7}
2. **Roster or Tabular form:** in this form all the elements are listed in curly brackets or braces{ } after separating by commas.
   Ex; If a set A consists of the numbers 1,3,5,7 then we write A = { 1,3,5,7}

3**. Set-Builder Form or Rule Method:**

In this form, all the elements of set possess a single common property , which is not possessed by any other element
outside the set.

If a particular set is defined by stating properties which its elements are to satisfy, then we write . A = { x| property(x)} and is read as ' A is the set of elements x such that x has the given property.

Ex: $A = \{ x | x \text{ is an integer }, -4 < x \leq 3\}$

A= { -3 ,-2,-1,0 , 1,2,3}

TYPES OF SETS

Finite and Infinite sets

A set is finite if it consists of a definite number of different elements, i.e., if in counting the different numbers of the set,the counting can come to an end .

1. The number of students in your school.
2. The set of months of a year.
3. The set of prime numbers less than 50.

A set is said to be an infinite set if the process of counting its elements never comes to an end.

For example,

1. The set of square numbers.
2. The set of all points on a line between two distinct points A and B on it.

The empty set or the null set

A set that contains no members is called the empty set or the null set.

For example, each one of the following is the empty set.

1. The set of the months of a year that have fewer than 15 days.
2. The set of even prime numbers greater than 2.

The empty set is written as { } or ∅.

(0} and { ∅} are not enmpty sets because each of these sets contains one element.

Singleton set

A set containing only one element is called a singleton set,

e.g., {a},{u}, {5} are singleton sets.

Equal sets

Two sets A and B are called identical or equal sets, written as A = B, if they have exactly the same elements.

For example

(1) If A= {1,2, 3, r}, and B {2,r,1,3 }, then A = B.

Cardinal number

The number of elements in a finite set is called the cardinal number of the set.

the cardinal number of a set A is abbreviated as n (A).

For example

If A = {a}, B= {a, b}, C= {p, q, r}, then n(A) = 1, n(B) = 2, n(C) = 3..

Note

1. Cardinal number of an infinite set is not defined.
2. Cardinal number of the empty set is zero, i.e., n(4) = 0.

Equivalent sets

Two finite sets A and B are said to be equivalent, if they have the same number of elements, i.e., if n(A) = n(B).

The equivalence of two sets A and B is expressed by writing A ↔B.

Let A = {a, b, c, d}, B = {p, q, r, s}, then since each set contains 4 elements, ie., n(4) = n(B) = 4, therefore, they are equivalent sets.

Let A = { 1,2,3,4,5} and B= { a,b,c,d,e}

Then n(A) = n(B) =5

⇒ The sets A and B are equivalent sets.

From the definition of equal and equivalent sets that equal sets are always equivalent but equivalent sets may or may not be equal.

Overlapping sets
Two sets are called overlapping sets if, they have at least one element in common.
For example, the sets A = {1,3,5,7} and B = {2,3,9,11} are overlapping sets, since the element 3 is common in them.

Disjoint sets
Two sets are called disjoint sets if they have no element in common.
For example, the set R = {1, 3, 5, 7}, S = {2, 4, 6, 8} are disjoint sets, since no element is common to them.

Intervals:

An interval is the set of all numbers between two endpoints on a number line.
In interval notation the symbols [ ] are used to include end points and is called as closed interval ,
( ) is called an open interval as it excludes the end points of the interval on the number line.
[a,b)is half open interval it contains one end point a but not b , (a,b] is also half open interval including b but not a.
In set descriptive form [a,b] is $\{ x \mid a \leq x \leq b\}$, (a,b) is $\{ x \mid a < x < b\}$, [a,b) is $\{x \mid a \leq x < b\}$,(a,b]is $\{ x \mid a < x \leq b\}$, [a ,∞) $\{ x \mid a \leq x < \infty\}$,(a,∞) is $\{ x \mid a < x < \infty\}$, (-a, ∞) is $\{ x \mid -a < x < \infty\}$ etc.

Subsets
Let A = la, e, i, o, u) and B = {a, b, c, d, e, ... x, y, z}
Here we observe that every element of set A is in set B. We say that set A is a subset of set B.
If two sets A and B are such that every element of set A is in set B, we say that A is a subset of B. We write $A \subseteq B$.
It is read as 'A is a subset of B'.
Symbolically, $A \subseteq B$ if and only if any $a \in A \Rightarrow a \in B$

Examples: {1}, {1, 2}, {1, 3} are subsets of {1, 2, 3}.
Remark. If A is not a subset of a set B, then we write $A \not\subseteq B$.

Super Set. $A \subset B$ is also expressed by writing $B \supset A$ and is read as "B contains A", or "B is a super set of A".

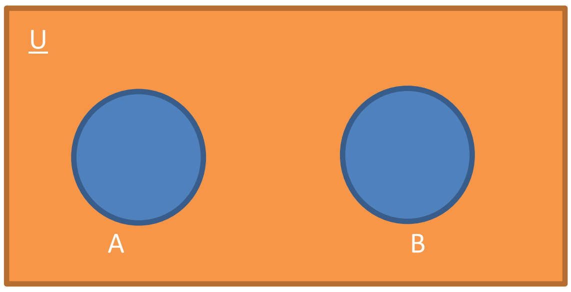
Proper Subset. A is called a proper subset of B if A is a subset of B and $A \neq B$ and this relationship is denoted by the symbol $A \subset B$ and is read as 'A is a proper subset of B'.

Power Set
A set formed by all the subsets of a set A as its elements are called the power set of A and is denoted by P(A).
Let A = { a,b}
The subsets of A are ∅, {a} {b} and {a, b}.
Then
P(A) = {∅, {a}, {b}, {a, b}}
Again, let S = {2, 4, 6}

The subsets of S are
∅, {2}, {4}, {6), {2, 4}, {4, 6}, {2, 6}, {2, 4, 6}
The power set of the given set S is P(S) = {∅, {2}, {4}, {6}, {2, 4}, {4, 6}, {2, 6}, {2, 4,6}}

Number of subsets : A set having n element has 2^n subsets.

Universal set: The set of elements from which elements may be chosen to form sets for a particular discussion. It is denoted by the symbol ξ ,U, E.
Venn Diagram: The relationships between sets can be represented by means of diagram which are known as Venn Diagram.



The rectangle represents the universal set and the circles represents the sets A and B.

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Operations on sets:

Union : The union of two sets say A and B is the the set consisting of all the elements present in either of the sets A or B or both.

A ∪ B = { x| x ∈ A or x ∈ B or x ∈ both A and B }

Ex: A = { 1,2,3} and B = { 4,5,6}

A ∪ B = { 1,2,3,4,5,6}

Intersection : The intersection of two sets is the elements which belongs to setA and set B both and is denoted by A ∩ B.

A ∩ B = { x| x ∈ A , x ∈ B }

A { a,b,c,d}   B = { a ,e,f,d} then A ∩ B = { a, d}

Difference of two sets :The difference of a set A with respect to set B is a set which contains only the elements present in set A which do not belong to set B and is denoted by A – B.

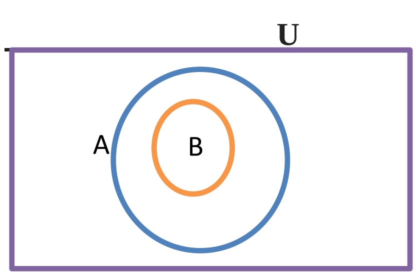
A = { 1,2,3,4,5} , B = { 4,5,6,7,8} then A – B = { 1,2,3}

Symmetric Difference of two sets : The symmetric difference between two sets is A Δ B

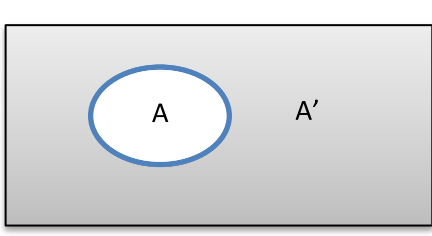
A Δ B = (A – B) ∪ (B – A)

Complement of a set : If A is a subset of the universal set U then the complement of A is all the elements which are present in U which do not belong to A and is denoted as A' or A^c or A

Venn Diagram to represent the relationship

1. 

B⊂ A

2. 

A' is the shaded part

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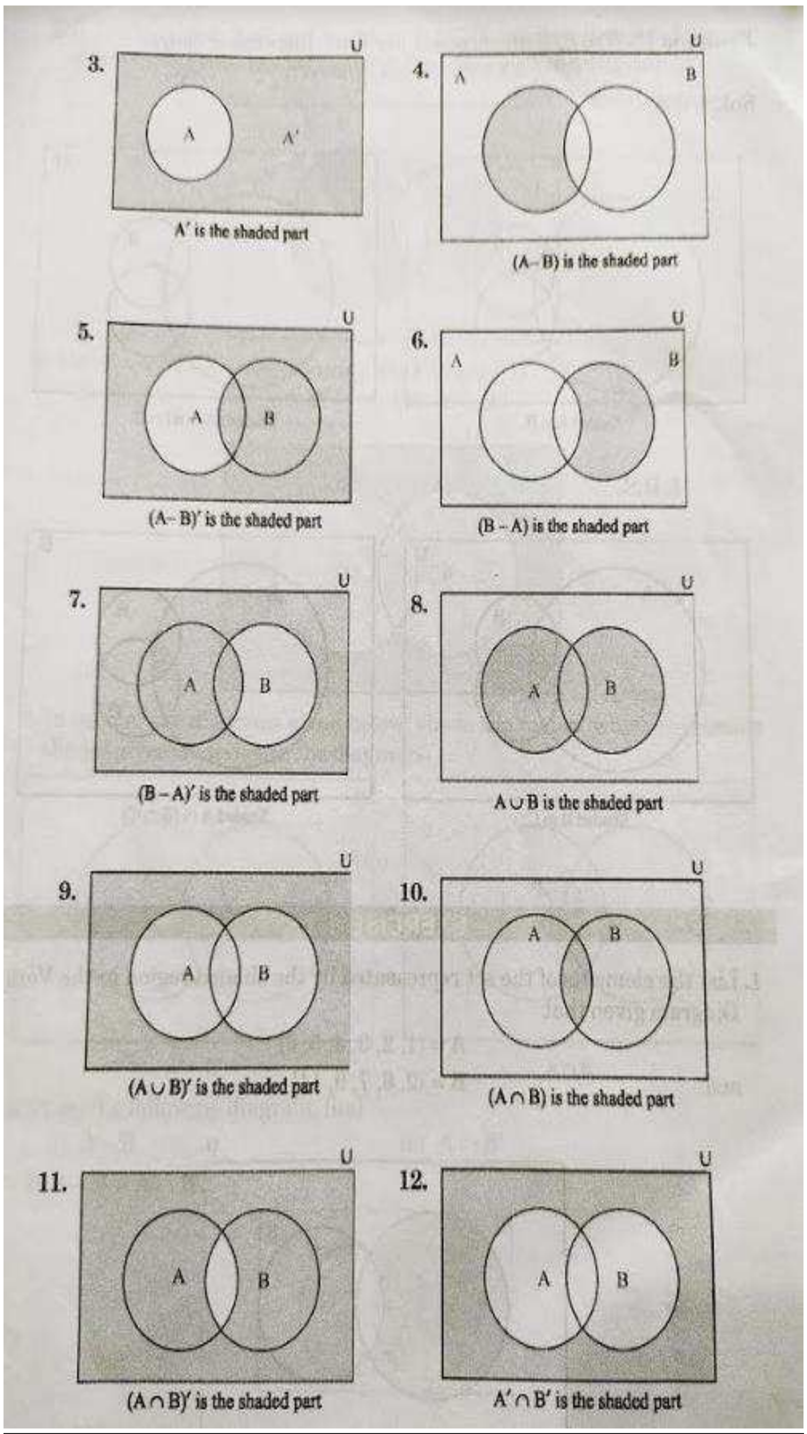


<u>De Morgan's Law'</u>

(i) $(A\cup B)' = A' \cap B'$

(ii) $(A \cap B)' = A' \cup B'$

To find the number of elements in the union of two sets . Let A and B be any two sets then there are two possibilities

i. The sets are disjoint , that is $A \cap B = \emptyset$, then $n(A \cup B) = n(A) + n(B)$
ii. The sets are not disjoint , that is $A \cap B \neq \emptyset$ then, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
iii. If A,B,C are any three sets , then

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

Example: In a town with a population of 5000, 3200 people are egg eaters, 2500 meat eaters and 1000 both egg and meat. How many are pure vegetarian?

Sol. Let E be the set of peoples who are egg eaters and M be the set of peoples who are meat-eaters.

$n(E) = 3200$, $n(M) = 2500$,
$n(E \cap M) = 1500$
$n(E \cup M) = n(E) + n(M) - n(E \cap M)$
$= 3200 + 2500 - 1500$
$= 5700 - 1500 = 4200$
Number of pure vegetarians
$= n(U) - n(E \cup M)$
$= 5000 - 4200 = 800$

<u>Exercise</u>

Q. Which of the following are sets?

1. The collection of all month of a year beginning with letter J.
2. The collection of all whole numbers less than 100.
3. A collection of most dangerous animal of the world.

Q. If A ={ p,q,r,s,t} , B = { 1,3,5,7……}and C = { 6,8,10,12…..} fill in the blanks with suitable signs $\notin$ or $\in$.

i. p…..A
ii. 8…..B
iii. R….C

Q. If S is the set of letters in the word 'pearl' and T is the letters in the word parallel , then is S = T

Q. Are the following sets equal?

A = { x |x is a letter of the word FLOW}

B = { x |x is a letter of the word WOLF}

C={ x |x is a letter of the word FOLLLOW}

Q. Write the following sets in Roster (Tabular)form :

1. The set of colours of the rainbow.

2. A= {x |x is a letter in the word SUNSET}

3. B = { x : x $= \frac{n}{n+1}$, n ϵ N and n $\leq$ 4}

4. C = { x |x is an integer and $-2 < x \leq 3$}

Q. Write the following sets in set builder form(i.e Rule method):

1. Negative multiples of 3.

2. Numbers more than 2 units from 8.

3. $x \neq 5$ and $x \leq 10$

4. { $1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}$…..}

5. { 23, 29}

Q. State whether each of the following sets is finite, infinite or empty sets :

1. D = { 0}

2. The set of circles through the origin (0,0).

3. {x : x is an integer , x < 5}

4. A= {x |x is a human being living on Mars }

5. The set of numbers which are multiple of 5.

Q. State the value of n(A) for each of the following sets .

1. A = { Months of the year}

2. A = { x : x is an even number}

Q. Write down all the subsets and the power set of the following sets :

1. {3}

2. { 2,5}

3. { 2,4,6}

Q. If A = { 1,2,3} , B = { 2,3,4} , C = { 3,4,5,6}and the universal set U = { 1,2,3,4,5…..9}

,then find A’,B’,C’.

Q.On a copy of Venn Diagram , shade the set

i. A ∪ (B ∩C)

ii. (A∩ B ∩ C)´

iii. A´ ∩ B∩ C

iv. (A ∪ C) ∩ B

Q. If = { 1,2,3,4} , A = { 1,4} , B = { 1,3} then list the elements of

i. A ´

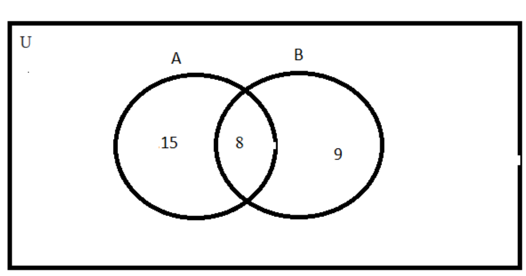
ii. (A ∩ B)´

iii.A´ ∩ B´

iv.(A ∪ B)´

Q.

1. The Venn diagram shows



U = {pupils in class 8}
A = {pupils who play cricket}
B= { pupils who play basketball}
How many pupils:

(i) are in class 8?
(ii) play cricket
(iii) play basketball?
(iv) Play both cricket and basketball
(v) play neither cricket nor basketball?

Q. In a group of 30 people, 18 play squash and 19 play tennis. How many play both games, provided everyone plays at least one game?

Q. In a class of 50 students, 22 like History, 25 like Geography and 10 like both subjects. Draw a Venn diagram and find the number of students who
(i) do not like History
(ii) like neither History nor Geography
(iii) do not like Geography

Q. 2000 candidates appear in a written test in Mathematics and Gerneral Awareness for a Government job. 1800 passed in at least one subject. If 1200 passed in Mathematics and 1500 in General Awareness find:
(i) how many passed in both the subjects?
(ii) how many passed in Mathematics only?
(Iii) how many failed in General Awareness?

Q. In a group of 80 people, 40 like Indian food, 36 like Chinese food and 27 do not like any kind of these foods. Draw Venn diagram to find:
(1) how many like both kind of food?
(ii) how many like only the Indian food?
(iii) how many like only the Chinese food?
