Std: 11 | Chapter – **1** SET | Sub: MATHS

Exercise 1.1

1. Which of the following are sets? Justify your answer.

(i) The collection of all the months of a year beginning with the letter J.

(ii) The collection of ten most talented writers of India.

(iii) A team of eleven best-Cricket batmen of the world.

(iv) The collection of all boys in your class.

(v) The collection of all natural numbers less than 100.

(vi) A collection of novels written by the writer Munshi Prem Chand.

(vii) The collection of all even integers.

(viii) The collection of questions in the chapter.

(ix) A collection of most dangerous animals of the world.

Ans. (i) The collection of all months of a year beginning with J is {January, June, July}, which is well defined and hence it forms a set.

(ii) The collection of most talented writers of India is not well defined because opinions about 'most talented writers' vary from person to person and hence it does not form a set.

(iii) A team of eleven best-cricket batmen of the world us not well defined because opinion about 'best-cricket batsmen' vary from person to person and hence it does not form a set.

(iv) The collection of all boys in your class is well defined and hence it forms a set.

(v) The collection of all natural numbers less than 100 is {1, 2, 3, ……., 99} which is well defined and hence it forms a set.

(vi) A collection of novels written by the writer Munshi Prem Chand is well defined and hence it forms a set.

(vii) The collection al all even integers is $\{\ldots\ldots\ldots, -4, -2, 0, 2, 4, \ldots\ldots\ldots\}$ which is well defined and hence it forms a set.

(viii) The collection of questions in this chapter is well defined and hence it forms a set.

(ix) A collection of most dangerous animals of the world is not well defined because opinion about 'most dangerous animals' vary from person to person and hence it does not form a set.

2. Let A = {1, 2, 3, 4, 5, 6}. Insert the appropriate symbol $\in$ or $\notin$ on the blank space:

(i) 5_____A

(ii) 8_____A

(iii) 0_____A

(iv) 4_____A

(v) 2_____A

(vi) 10_____A

Ans. Given: A = {1, 2, 3, 4, 5, 6}

(i) 5 is an element of set A

∴ $5 \in A$

(ii) 8 is not an element of set A

∴ $8 \notin A$

(iii) 0 is not an element of set A

∴ $0 \notin A$

(iv) 4 is an element of set A

∴ $4 \in A$

(v) 2 is an element of set A

2 $\notin$ A

(vi) 10 is not an element of set A

10 $\notin$ A

3. Write the following sets in roster form:

(i) A = $\{x : x$ is an integer and $-3 < x < 7\}$

(ii) B = $\{x : x$ is a natural number less than 6}

(iii) C = $\{x : x$ is a two-digit natural number such that the sum of its digits is 8}

(iv) D = $\{x : x$ is a prime number which is divisor of 60}

(v) E = The set of all letters in the word TRIGONOMETRY

(vi) F = The set of all letters in the word BETTER

Ans. (i) A = $\{x : x$ is an integer and $-3 < x < 7\}$ ∴ A = $\{-2, -1, 0, 1, 2, 3, 4, 5, 6\}$

(ii) B = $\{x : x$ is a natural number less than 6} ∴ B = $\{1, 2, 3, 4\ 5\}$

(iii) C = $\{x : x$ is a two-digit natural number such that the sum of its digits is 8} ∴ C = $\{17, 26, 35, 44, 53, 62, 71, 80\}$

(iv) D = $\{x : x$ is a prime number which is divisor of 60} ∴ D = $\{2, 3, 5\}$

(v) E = The set of all letters in the word TRIGONOMETRY

∴ E = $\{T, R, I, G, O, N, M, E, Y\}$

(vi) F = The set of all letters in the word BETTER

F = $\{B, E, T, R\}$

4. Write the following sets in the set-builder

form: (i) {3, 6, 9, 12}

(ii) {2, 4, 8, 16, 32}

(iii) {5, 25, 125, 625}

(iv) {2, 4, 6, ...}

(v) {1, 4, 9, ..., 100}

Ans. (i) Let A = {3, 6, 9, 12}.

Here all objects of the set are natural numbers that are multiples of 3.

$$A = \{x : x = 3n, n \in N \text{ and } 1 \leq n \leq 4\}$$

(ii) Let B = {2, 4, 8, 16, 32}

Here all objects of the set are natural numbers that are power of 2.

$$B = \{x : x = 2^n, n \in N \text{ and } 1 \leq n \leq 5\}$$

(iii) Let C = {5, 25, 125, 625}

Here all objects of the set are natural numbers that are power of 5.

$$C = \{x : x = 5^n, n \in N \text{ and } 1 \leq n \leq 4\}$$

(iv) Let D = {2, 4, 6, ...}
Here all objects of the set are even natural numbers.

$$D = \{x : x \text{ is an even natural number}\}$$

(v) Let E = {1, 4, 9, ..., 100}

Here all objects of the set are perfect square.

$$\therefore \quad D = \left\{ x : x = n^2 \text{ and } 1 \le n \le 10 \right\}$$

5. List all the elements of the following sets:

(i) A = { $x : x$ is an odd natural number}

(ii) B = { $x : x$ is an integer, $\dfrac{1}{2} < x < \dfrac{9}{2}$ }

(iii) C = { $x : x$ is an integer, $x^2 \le 4$ }

(iv) D = { $x : x$ is a letter in the word "LOYAL"}

(v) E = { $x : x$ is a month of a year not having 31 days}

(vi) F = { $x : x$ is a consonant in the English alphabet which precedes

Ans. (i) A = { $x : x$ is an odd natural number}

$\therefore \quad$ A = {1, 3, 5, 7, ... }

(ii) B = { $x : x$ is an integer, $-\dfrac{1}{2} < x < \dfrac{9}{2}$ }

B = {0, I, 2, 3, 4}

(iii) C = { $x : x$ is an integer, $x^2 \le 4$ }

C = $\left\{-2, -1, 0, 1, 2\right\}$

(IV) D = { $x : x$ is a letter in the word "LOYAL"}

D = {L, O, Y, A}

E = { $x : x$ is a month of a year not having 31 days}

E = { $February. April, \ june, \ september, November$ }

(iii) F = { $x : x$ is a consonant in the English alphabet which precedes K} - F =

{B, C, D, F, G, H, J}

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1. Match each of the set on the left in the roster form with the same set on the right described in the set-builder form:

(i) {1, 2, 3, 6}

(a) { $x : x$ is a prime number and a divisor of 6}

(ii) {2, 3}

(b) { $x : x$ is an odd natural number less than 10}

(iii) {M, A, T, H, E, I, C, S}

(c) { $x : x$ is a natural number and divisor of

6} (iv) {!, 3, 5, 7, 9}

(d) { $x : x$ is a letter of word "MATHEMATICS"}

Ans. The sets which are in set-builder form can be written as

(a) { $x : x$ is a prime number and a divisor of 6} = {2, 3}

(b) { $x : x$ is an odd natural number less than 10} = {1, 3, 5, 7, 9}

(c) { $x : x$ is a natural number and divisor of 6} = {1, 2, 3, 6}

(d) { $x : x$ is a letter of word "MATHEMATICS"} = {M, A, T, H, E, I, C, S}

Hence the correct matching is:

(i) → (c)
(ii) → (a)
(iii) → (d)
(iv) → (b)

Exercise 1.2

1. Which of the following are examples of the null set:

(i) Set of odd natural numbers divisible by 2.

(ii) Set of even prime numbers.

(iii) $\{ x : x$ is a natural number, $x < 5$ and $x > 7 \}$

(iv) $\{ y : y$ **is a point common to any two parallel lines}**

Ans. (i) Set of odd natural numbers divisible by 2 is an empty set because odd natural numbers are not divisible by 2.

(ii) Set of even prime numbers is {2} which is not empty set.

(iii) $\{ x : x$ is a natural number, $x < 5$ and $x > 7$ } is an empty set because there is no natural number which satisfies simultaneously $x < 5$ and $x > 7$.

(iv) $\{ y : y$ is a point common to any two parallel lines} is an empty set because two parallel lines do not have a common point.

2. Which of the following sets are finite or infinite:

(i) The set of months of a year.

(ii) $\{1, 2, 3, \ldots\ldots\ldots\}$

(iii) $\{1, 2, 3, \ldots\ldots\ldots\ldots, 99, 100\}$

(iv) The set of positive integers greater than 100.

(v) The set of prime numbers less than 99.

Ans. (i) The set of months of a year is finite set because there are 12 months in a year.

(ii) {1, 2, 3, ...} is an infinite set because there are infinite elements in the set.

(iii) {1, 2, 3, ..., 99, 100} is a finite set because the set contains finite number of elements.

(iv) The set of positive integers greater than 100 is an infinite set because there are infinite number of positive integers greater than 100.

(v) The set of prime numbers less than 99 is a finite set because the set contains finite number of elements.

3. State whether each of the following sets is finite or infinite:

(i) The set of lines which are parallel to the $x-$ axis.

(ii) The set of letters in the English alphabet.

(iii) The set of numbers which are multiple of 5.

(iv) The set of animals living on the earth.

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

Ans. (i) The set of lines which are parallel to the $x-$ axis is an infinite set because we can draw infinite number of lines parallel to $x-$ axis.

(ii) The set of letters in the English alphabet is a finite set because there are 26 letters in the English alphabet.

(iii) The set of numbers which are multiple of 5 is an infinite set because there are infinite multiples of 5.

(iv) The set of animals living on the earth is a finite set because the number of animals living on the earth is every large but finite.

(v) The set of circles passing through the origin (0, 0) is an infinite set because we can draw infinite number of circles through origin in different radii.

4. In the following, state whether A = B or not:

(i) A = $\{a, b, c, d\}$ B = $\{d, c, b, a\}$

(ii) A = {4, 8, 12, 16} B = {8, 4, 16, 18}

(iii) A = {2, 4, 6, 8, 10} B = {$x : x$ is a positive even integer and $x \leq 10$}

(iv) A = {$x : x$ is a multiple of 10}   B = {10, 15, 20, 25, 30, ...}

Ans. (i) A = $\{a, b, c, d\}$ and B = $\{d, c, b, a\}$ are equal sets because order

of elements does not change a set. $\{a, b, c, d\}$
Therefore, A = B =

(ii) A = {4, 8, 12, 16} and B = {8, 4, 16, 18} are not equal sets because 12 $\in$ A, 12 $\notin$ B and 18
$\in$ B,19 A

(iii) A = {2, 4, 6, 8, 10} and B = { $x : x$ is a positive even integer and $x \leq 10$} which can be
written in roster form as B = {2, 4, 6, 8, 10} are equal sets.

(iv) A = { $x : x$ is a multiple of 10} can be written in roster form as A = {10, 20, 30, 40, ...}
and B = {10, 15, 20, 25, 30, ...} are not equal sets because 15 $\in$ B, 15 $\notin$ A.

5. Are the following pairs of sets equal? Give reason.

(i) A = {2, 3} and B = {$x : x$ is a solution of $x^2 + 5x + 6 = 0$}

(ii) A = :$x : x$ is a letter in the word FOLLOW} and

B = {$y : y$ is a letter in the word WOLF}

Ans. (i) A = {2, 3} and

B = { $x : x$ is a solution of $x^2 + 5x + 6 = 0$ }

Here $x^2 + 5x + 6 = 0$

$\Rightarrow (x+3)(x+2) = 0$

$\Rightarrow x = -3, -2$

$\therefore$ B = $\{-2, -3\}$

Therefore, A and B are not equal sets.

(ii) A = : $x : x$ is a letter in the word FOLLOW} = {F, O, L,

W} B = { $y : y$ is a letter in the word WOLF} = {W, O, L, F}

Therefore, A = B = {F, O, L, W}

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6. **From the sets given below, select equal sets:**

A = **{2, 4, 8, 12}**

B = **{1, 2, 3, 4}**

C = **{4, 8, 12, 14}**

D = **{3, 1, 4, 2}**

E = $\{-1, 1\}$

F = $\{0, a\}$

G = $\{1, -1\}$

H = **{0, 1}**

Ans. From the given sets, Set B and D have same elements and also sets E and G have same element.

Exercise 1.3

1. Make correct statements by filling in the symbols $\subset$ or $\not\subset$ in the blank spaces: (i) {2, 3, 4}_____{1, 2, 3, 4, 5}

(ii) $\{a,b,c\}$ _____ $\{b,c,d\}$

(iii) { $x : x$ is a student of class XI of your school}_____{ $x : x$ student of your school}

(iv) { $x : x$ is a circle in the plane}_____{ $x : x$ is a circle in the same plane with radius 1 unit}

(v) { $x : x$ is a triangle in plane}_____{ $x : x$ is a rectangle in the same plane}

(vi) { $x : x$ is an equilateral triangle in a plane}_____{ $x : x$ is a rectangle in the same plane}

(vii) { $x : x$ is an even natural number}_____{ $x : x$ is an integer} Ans. (i) $\subset$**

(ii) $\not\subset$

(iii) $\subset$

(iv) $\not\subset$

(v) $\not\subset$

(vi) $\subset$

(vii) $\subset$

2. Examine whether the following statements are true or false:

(i) $\{a,b\} \not\subset \{b,c,a\}$

(ii) $\{a, e\} \subset \{x : x$ **is a vowel in the English**

alphabet} **(iii)** $\{1, 2, 3\} \subset \{1, 3, 5\}$

(iv) $\{a\} \subset \{a, b, c\}$

(v) $\{a\} \in \{a, b, c\}$

(vi) $\{x : x$ **is an even natural number less than 6}** $\subset \{x : x$ **is a natural number which divide 36}**

Ans. (i) Let A = $\{a, b\}$ and B = $\{b, c, a\}$

Here, every element of set A is an element of set B.

$\therefore$ A $\subseteq$ B

Therefore, statement is false.

(ii) Let A = $\{a, e\}$ and B

= $\{x : x$ is a vowel in the English alphabet}

= $\{a, e, i, o, u\}$

Here, every element of set A is an element of set B.

$\therefore$ A $\subset$ B

Therefore, statement is true.

(iii) Let A = {1, 2, 3} and B = {1, 3, 5}

Here, 2 $\in$ A but 2 $\notin$ B

$\therefore$ A $\not\subset$ B

Therefore, statement is false.

(iv) Let A = $\{a\}$ and B = $\{a, b, c\}$

Here, every element of set A is an element of set B.

∴   A ⊂ B

Therefore, statement is true.

(v) Let A = $\{a\}$ and B =

$\{a, b, \{a\}\}$ Here,   B

Therefore, statement is false.

(vi) Let A = { x : x is an even natural number less than 6}

= {2, 4}

And B = } ⊂ { x : x is a natural number which divide 36}

= {1, 2, 3, 4, 6, 12, 18, 36]

Here, every element of set A is an element of set B.

∴   A ⊂ B

Therefore, statement is true.

3. Let A = {1, 2, {3, 4}, 5}. Which of the following statements are incorrect and

why: (i) {3, 4} ⊂ A

(ii) {3, 4} ∈ A

(iii) {{3, 4}} ⊂ A

(iv) 1 ∈   A

(v) 1 ⊂ A

(vi) $\{1, 2, 5\} \subset A$

(vii) $\{1, 2, 5\} \in A$

(viii) $\{1, 2, 3\} \subset A$

(ix) $\phi \in A$

(x) $\phi \subset A$

(xi) $\{\phi\} \subset A$

Ans. (i) $\{3, 4\}$ is a member of set A.

$\Rightarrow$ $\{3, 4\} \in A$

Therefore, $\{3, 4\} \subset A$ is incorrect.

(ii) $\{3, 4\}$ is a member of set A. Therefore, $\{3, 4\} \in A$ is correct.

(iii) $\{3, 4\}$ is a member of set A.

$\Rightarrow$ $\{\{3, 4\}\}$ is a set.

Therefore, $\{\{3,4\}\} \subset A$ is correct

(iv) 1 is a member of set A. Therefore $1 \in A$ is correct.

(v) 1 is not a set, it is a member of set A. Therefore, $1 \subset A$ is incorrect.

(vi) 1, 2, 5 are the members of set A.

$\Rightarrow$ $\{1, 2, 5\}$ is a subset of set A.

Therefore, $\{1,2,5\} \subset A$ is correct.

(vii) 1, 2, 5 are the members of set A.

$\Rightarrow$ $\{1, 2, 5\}$ is a subset of set A.

Therefore, $\{1,2,5\} \in A$ is incorrect.

(viii) 3 is not a member of set A.

$\Rightarrow$ {1, 2, 3} is not a subset of set A.

Therefore, {1, 2, 3} $\subset$ A is incorrect.

(ix) ϕ is not a member of set A. Therefore, $\phi \in$ A is incorrect.

(x) ϕ is subset of all sets. Therefore, $\phi \subset$ A is correct.

(xi) ϕ is a subset of A and it is not an element of A. So this statement is incorrect.

4. Write down all the subsets of the following

sets: (i) $\{a\}$

(ii) $\{a, b\}$

(iii) $\{1, 2, 3\}$

(iv) ϕ

Ans. (i) Number of elements in given set = 1. Number of

subsets of given set = $2^1 = 2$

Therefore, Subsets of given set are $\phi, \{a\}$.

(ii) Number of elements in given set = 2

Number of subsets of given set = $2^2 = 4$

Therefore, Subsets of given set are

$\phi, \{a\}, \{b\}, \{a, b\}$.

(iii) Number of elements in given set = 3

Number of subsets of given set = $2^3 = 8$

$\phi, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{2, 3\}, \{1, 3\}, \{1, 2, 3\}$.

Therefore, Subsets of given set are

(iv) Number of elements in given set = 0

Number of subsets of given set = 2^0 = 1

Therefore, Subsets of given set are ϕ.

5. How many elements has P(A), if A = ϕ ?

Ans. Number of elements in set A = 0

Number of subsets of given set = 2^0 = 1

Therefore, number of elements of P (A) is 1.

6. Write the following as intervals:

(i) { $x : x \in$ **R,** $-4 < x \le 6$ }

(ii) { $x : x \in$ **R, -12<x<-10**}

(iii) x{ $x \in$ **R,** $0 \le x < 7$ }

(iv) x{ $x \in$ **R,** $3 \le x \le 4$ }

Ans. (i) Let A = { $x : x \in$ R, $-4 < x \le 6$ }

It can be written in the form of interval as $\left(-4, 6\right]$

(ii) Let A = { $x : x \in$ R, $-12 < x \le -10$ }

It can be written in the form of interval as $\left(-12, -10\right)$

(iii) Let A = { $x : x \in$ R, $0 \le x < 7$ }

It can be written in the form of interval as $\left[0, 7\right)$

(iv) Let A= {   R,   }
      $x : x \in$

It can be written in the form of interval as $\left[3,4\right]$

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7. Write the following intervals in set-builder form:

(i) $\left(-3,0\right)$

(ii) [6, 12]

(iii) (6,

12] (iv)

$\left[-23,5\right)$

Ans. (i) $\{ : x \in \ R, -3 < x < 0 \}$

(ii) $\{ : x \in \ R, 6 \leq x \leq 12 \}$

(iii) $\{ : x \in \ R, 6 < x \leq 12 \}$

(iv) $\{ : x \in \ R, -12 \leq x < 5 \}$

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8. What universal set(s) would you propose for each of the following:

(i) The set of right triangles

(ii) The set of isosceles triangles

Ans. (i) Right triangle is a type of triangle. Therefore, the set of triangles contain all types of triangles.

∴ U = { $x : x$ is a triangle in plane}

(ii) Isosceles triangle is a type of triangle. Therefore, the set of triangles contain all types of triangles.

∴ U = { $x : x$ is a triangle in plane}

Exercise 1.4

1. Find the union of each of the following pairs of sets:

(i) X = {1, 3, 5} and Y = {1, 2, 3}

(ii) A = {a,e,i,o,u} and B = {a,b,c}

(iii) A = {x:x is a natural number and multiple of 3} and B = {x:x is a natural number less than 6}

(iv) A = {x:x is a natural number and $1 < x \leq 6$} and B = {x:x is a natural number and 6<x<10}

(v) A = {1, 2, 3} and B = ϕ

Ans. (i) $X \cup Y = \{1, 2, 3, 5\}$

(ii) $A \cup B = \{a, b, c, e, i, o, u\}$

(iii) $A \cup B = \{1, 2, 3, 4, 5, 6, 9, 12, 15, \ldots\ldots\ldots\}$ or

$A \cup B = \{x : x = 1, 2, 4, 5$ or a multiple of 3 $\}$

(iv) $A \cup B = \{2, 3, 4, 5, 6, 7, 8, 9\}$

or $A \cup B = \{x : 1 < x < 10, x \in$

N}

(v) $A \cup B = \{1, 2, 3\}$

2. Let A = $\{a, b\}$ and B = $\{a, b, c\}$. Is A $\subset$ B? What is A $\cup$ B?

Ans. Given: A $= \{a, b\}$ and B $= \{a, b, c\}$.

Here all elements of set A are present in set B.

$\therefore$ A $\subset$ B and

$A \cup B = \{a, b, c\} = B$

3. If A and B are two sets such that A $\subset$ B, then what is A $\cup$ B?

Ans. Given: A and B are two sets such that A $\subset$ B

Taking A = {1, 2} and B = {1, 2, 3}, then A $\cup$ B = {1, 2, 3} = B

So A $\cup$ B = B

4. If A = {1, 2, 3, 4}, B = {3, 4, 5, 6}, C = {5, 6, 7, 8} and D = {7, 8, 9, 10}; find:

(i) A $\cup$ B

(ii) A $\cup$ C

(iii) B $\cup$ C

(iv) B $\cup$ D

(v) A $\cup$ B $\cup$ C

(vi) A $\cup$ B $\cup$ D

(vii) B $\cup$ C $\cup$ D

Ans. Given: A = {1, 2, 3, 4}, B = {3, 4, 5, 6}, C

= {5, 6, 7, 8} and D = {7, 8, 9, 10}

(i) A $\cup$ B = {1, 2, 3, 4} $\cup$ {3, 4, 5,6}

  So, A $\cup$ B= {1, 2, 3, 4, 5, 6}

(ii) A $\cup$ C = {1, 2, 3, 4} $\cup$ {5, 6, 7, 8}

  So, A $\cup$ C = {1, 2, 3, 4, 5, 6, 7, 8}

 (iii) B $\cup$ C = {3, 4, 5, 6} $\cup$ {5, 6, 7, 8}

So, B $\cup$ C = {3, 4, 5, 6, 7, 8}

 (iv) B $\cup$ D = {3, 4, 5, 6} $\cup$ {7, 8, 9, 10}

 So, B $\cup$ D = {3, 4, 5, 6, 7, 8, 9, 10}

(v) A $\cup$ B $\cup$ C = {1, 2, 3, 4} $\cup$ {3, 4, 5, 6} $\cup$ {5, 6, 7,8}

 So, A $\cup$ B $\cup$ C = {1, 2, 3, 4, 5, 6, 7, 8}

(vi) A $\cup$ B $\cup$ D = {1, 2, 3, 4} $\cup$ {3, 4, 5, 6} $\cup$ {7, 8, 9,10}

 So, A $\cup$ B $\cup$ D = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

(vii) B $\cup$ C $\cup$ D = {3, 4, 5, 6} $\cup$ {5, 6, 7, 8} $\cup$ {7, 8, 9, 10}

 So, B $\cup$ C $\cup$ D = {3, 4, 5, 6, 7, 8, 9, 10}

5. Find the intersections of each pair of sets of question 1 above.

Ans. (i) X $\cap$ Y = {1, 3}

(ii) A $\cap$ B = $\{a\}$

(iii) A $\cap$ B = {3}

(iv) A $\cap$ B = $\emptyset$

(v) A $\cap$ B = $\emptyset$

6. If A = {3, 5, 7, 9, 11}, B = {7, 9, 11, 13}, C = {11, 13, 15} and D = {15, 17}; find:

(i) A $\cap$ B

(ii) B $\cap$ C

(i) A $\cap$ C $\cap$ D

(ii) A ∩ C

(iii) B ∩ D

(iv) A ∩ (B ∪ C)

(v) A ∩ D

(vi) A ∩ (B ∪ D)

(vii) (A ∩ B) ∩ (B ∪ C)

(viii) **(A ∪ D) ∩ (B ∪**

C) Ans. Given: A = {3, 5, 7,

9, 11}, B = {7, 9, 11, 13},

C = {11, 13, 15} and D = {15, 17}

(i) A ∩ B = {3, 5, 7, 9, 11} ∩ {7, 9, 11, 13}

= {7, 9, 11}

(ii) B ∩ C = {7, 9, 11, 13} ∩ {11, 13, 15}

= {11, 13}

(iii) A ∩ C ∩ D

= {3, 5, 7, 9, 11} ∪ {11, 13, 15} ∩ {15, 17} = ϕ

(iv) A ∩ C = {3, 5, 7, 9, 11} ∩ {11, 13, 15} = {11}

(v) B ∩ D = {7, 9, 11, 13} ∩ {15, 17} = ϕ

(vi) A ∩ (B ∪ C) = {3, 5, 7, 9, 11} ∩ ({7, 9, 11, 13} ∪ {11, 13, 15})

= {3, 5, 7, 9, 11} ∩ {7, 9, 11, 13, 15, 17} = {7, 9, 11}

(vii) A ∩ C = {3, 5, 7, 9, 11} ∩ {15, 17} ϕ

(viii) $A \cap (B \cup D) = \{3, 5, 7, 9, 11\} \cap (\{7, 9, 11, 13\} \cup \{15, 17\})$

$= \{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13, 15, 17\} = \{7, 9, 11\}$

(ix) $(A \cap B) \cap (B \cup C)$

$= (\{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13\}) \cap (\{7, 9, 11, 13\} \cup \{11, 13, 15\})$

$= \{7, 9, 11\} \cap \{7, 9, 11, 13, 15\} = \{7, 9, 11\}$

(x) $(A \cup D) \cap (B \cup C)$

$= (\{3, 5, 7, 9, 11\} \cup \{15, 17\}) \cap (\{7, 9, 11, 13\} \cup \{11, 13, 15\})$

$= \{3, 5, 7, 9, 11, 15, 17\} \cap \{7, 9, 11, 13, 15\} = \{7, 9, 11, 15\}$

7. If A = {x:x is a natural number}, B = {x:x is an even natural number}, C = {x:x is an odd natural number} and D = {x:x is a prime number}, find:

(i) A ∩ B

(ii) A ∩ C

(iii) A ∩ D

(iv) B ∩ C

(v) B ∩ D

(vi) C ∩ D

Ans. (i) $A \cap B = \{x : x$ is a natural number$\} \cap \{x : x$ is an even natural number$\} = B$

(ii) $A \cap C = \{x : x$ is a natural number$\} \cap \{x : x$ is an odd natural number$\} = C$

(III) $A \cap D = \{x : x$ is a natural number$\} \cap \{x : x$ is a prime number$\} = D$

(iii) $B \cap C = \{x : x$ is an even natural number$\} \cap \{x : x$ is an odd natural number$\} = \emptyset$

(iv) $B \cap D = B \cap C = \{x : x$ is an even natural number$\} \cap \{x : x$ is a prime number$\} = \{2\}$

(v) $C \cap D = \{x : x$ is an odd natural number$\} \cap \{x : x$ is a prime number$\}$

= $\{x : x$ is an odd prime number$\}$

8. Which of the following pair of sets are disjoint:

(i) $\{1, 2, 3, 4\}$ and $\{x : x$ is a natural number and $4 \leq x \leq 6\}$

(ii) $\{a, e, i, o, u\}$ and $\{c, d, e, f\}$

(iii) $\{x : x$ is an even integer$\}$ and $\{x : x$ is an odd integer$\}$

Ans. (i) Let A = $\{1, 2, 3, 4\}$ and B = $\{x : x$ is a natural number and $4 \leq x \leq 6\}$ = $\{4, 5,$

6$\}$ A $\cap$ B = $\{4\}$

Therefore, A and B are not disjoint.

(ii) Let A = $\{a, e, i, o, u\}$ and B =

$\{c, d, e, f\}$ A $\cap$ B = $\{e\}$

Therefore, A and B are not disjoint.

(iii) Let A = $\{x : x$ is an even integer$\}$ and B = $\{x : x$ is an odd

integer$\}$ A B = ϕ

Therefore, A and B are disjoint.

9. If A = {3, 6, 9, 12, 15, 18, 21}, B = {4, 8, 12, 16, 20}, C = {2, 4, 6, 8, 10, 12 , 14, 16},

D = {5, 10, 15, 20}; find:

(i) A –B

(ii) A –C

(iii) A –D

(iv) B –A

(v) C –A
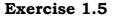
(vi) D –A

(vii) B –C

(viii) B –D

(ix) C –B

(x) D –B

(xi) C –D

(xii) D –C

Ans. Given: A = {3, 6, 9, 12, 15, 18, 21},

B = {4, 8, 12, 16, 20},

C = {2, 4, 6, 8, 10, 12 , 14, 16},

D = {5, 10, 15, 20};

(i) A – B = {3, 6, 9, 12, 15, 18, 21} – {4, 8, 12, 16, 20}

= {3, 6, 9, 15, 18, 21}

(ii) A – C = {3, 6, 9, 12, 15, 18, 21} – {2, 4, 6, 8, 10, 12 , 14, 16}

= {3, 9, 15, 18, 21}

(iii) A – D = {3, 6, 9, 12, 15, 18, 21} – {5, 10, 15, 20}

= {3, 6, 9, 12, 18, 21}

(iv) B – A = {4, 8, 12, 16, 20} – {3, 6, 9, 12, 15, 18, 21}

= {4, 8, 16, 20}

(v) C – A = {2, 4, 6, 8, 10, 12 , 14, 16} – {3, 6, 9, 12, 15, 18, 21}

= {2, 4, 8, 10,14, 16}

(vi) D – A = {5, 10, 15, 20} – {3, 6, 9, 12, 15, 18, 21}

= {5, 10, 20}

(vii) B – C = {4, 8, 12, 16, 20} – {2, 4, 6, 8, 10, 12 , 14, 16} = {20}

(viii) B – D = {4, 8, 12, 16, 20} – {5, 10, 15, 20}

= {4, 8, 12, 16}

(ix) C – B = {2, 4, 6, 8, 10, 12 , 14, 16} – {4, 8, 12, 16, 20}

= {2, 6, 10, 14}

(x) D – B = {5, 10, 15, 20} – {4, 8, 12, 16, 20}

= {5, 10, 15}

(xi) C – D = {2, 4, 6, 8, 10, 12 , 14, 16} – {5, 10, 15, 20}

= {2, 4, 6, 8, 12, 14, 16}

(xii) D – C = {5, 10, 15, 20} – {2, 4, 6, 8, 10, 12 , 14, 16}

= {5, 15, 20}

10. If X = $\{a, b, c, d\}$ **and Y =** $\{f, b, d, g\}$, **find:**

(i) X – Y
(ii) Y – X
(iii) X ∩ Y

Ans. Given: X = $\{a, b, c, d\}$ and Y = $\{f, b, d, g\}$

(i) X – Y = $\{a, b, c, d\} - \{f, b, d, g\} = \{a, c\}$

(ii) Y – X = $\{f, b, d, g\} - \{a, b, c, d\} = \{f, g\}$

(iii) X ∩ Y = $\{a, b, c, d\} \cap \{f, b, d, g\} = \{b, d\}$

11. If R is the set of real numbers and Q is the set of rational numbers, then what is R – Q?

Ans. We know that set of real numbers contain rational and irrational numbers.

Therefore, R – Q = set of irrational numbers.

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12. State whether each of the following statements is true or false. Justify your answer.

(i) {2, 3, 4, 5} and {3, 6} are disjoint sets.

(ii) $\{a, e, i, o, u\}$ and $\{a, b, c, d\}$ are disjoint sets.

(iii) {2, 6, 10, 14} and {3, 7, 11, 15} are disjoint sets.

(iv) {2, 6, 10} and {3, 7, 11} are disjoint sets.

Ans. (i) Let A = {2, 3, 4, 5} and B = {3, 6}

$\therefore$ A $\cap$ B = {3}

$\therefore$ A and B are not disjoint. Therefore, statement is false.

(ii) Let A = $\{a, e, i, o, u\}$ and B = $\{a, b, c, d\}$

$\therefore$ A $\cap$ B = $\{a\}$

$\therefore$ A and B are not disjoint. Therefore, statement is false.

(iii) Let A = {2, 6, 10, 14} and B = {3, 7, 11, 15}

$\therefore$ A $\cap$ B = ϕ

$\therefore$ A and B are disjoint. Therefore, statement is true.

(iv) Let A = {2, 6, 10} and B = {3, 7, 11}

$\therefore$ A $\cap$ B = ϕ

$\therefore$ A and B are disjoint. Therefore, statement is true.

1. Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9}, A = {1, 2, 3, 4}, B = {2, 4, 6, 8} and C = {3, 4, 5, 6}. Find:

(i) A'

(ii) B'

(iii) (A $\cup$ C)'

(iv) (A $\cup$ B)'

(v) (A')'

(vi) (B − C)'

Ans. Given: U = {1, 2, 3, 4, 5, 6, 7, 8, 9},

A = {1, 2, 3, 4},

B = {2, 4, 6, 8} and C = {3, 4, 5, 6}.

(i) A' = U − A = {1, 2, 3, 4, 5, 6, 7, 8, 9} − {1, 2, 3, 4}

=> A' = {5, 6, 7, 8, 9}

(ii) B' = U − B = {1, 2, 3, 4, 5, 6, 7, 8, 9} − {2, 4, 6, 8}

=> B' = {1, 3, 5, 7, 9}

(iii) (A $\cup$ C)' = U − (A $\cup$ C)

=>(A $\cup$ C)'= {1,2,3,4,5,6,7,8,9}−({1,2,3,4} $\cup$ {3,4,5,6})

=>(A $\cup$ C)' = {1, 2, 3, 4, 5, 6, 7, 8, 9} − {1, 2, 3, 4, 5, 6}

=>(A $\cup$ C)' = {7, 8,9}

(iii) (A $\cup$ B)' = U − (A $\cup$ B)

=>(A $\cup$ B)'={1,2,3,4,5,6,7,8,9}−({1,2,3,4} $\cup$ {2,4,6,8})

=>(A $\cup$ B)' = {1, 2, 3, 4, 5, 6, 7, 8, 9} – {1, 2, 3, 4, 6, 8}

=> (A $\cup$ B)' = {5, 7,9}

(v) (A')' = U – A' = U – (U – A)

=> (A')' = {1, 2, 3, 4, 5, 6, 7, 8, 9} – ({1, 2, 3, 4, 5, 6, 7, 8, 9} – {1, 2, 3, 4})

=> (A')' = {1, 2, 3, 4, 5, 6, 7, 8, 9} – {5, 6, 7, 8, 9}

=> (A')' {1, 2, 3, 4}

=> (A')' = A

(vi) (B – C)' = U – (B – C)

=> (B – C)' = {1, 2, 3, 4, 5, 6, 7, 8, 9} – ({2, 4, 6, 8} – {3, 4, 5, 6})

=> (B – C)' = {1, 2, 3, 4, 5, 6, 7, 8, 9} – {2, 8}

=> (B – C)' = {1, 3, 4, 5, 6, 7, 9}

2. If U = $\{a, b, c, d, e, f, g, h\}$, find the complement of the following sets:

(i) A = $\{a, b, c\}$

(ii) B = $\{d, e, f, g\}$

(iii) C = $\{a, c, e, g\}$

(iv) D = $\{f, g, h, a\}$

Ans. Given: U = $\{a, b, c, d, e, f, g, h\}$

(i) A' = U – A

$\{a, b, c, d, e, f, g, h\} - \{a, b, c\} = \{d, e, f, g, h\}$

(ii) B' = U – B

$= \{a,b,c,d,e,f,g,h\} - \{d,e,f,g\} = \{a,b,c,h\}$

(iii) C' = U – C

$= \{a,b,c,d,e,f,g,h\} - \{a,c,e,g\} = \{b,d,f,h\}$

(iv) D' = U –D

$= \{a,b,c,d,e,f,g,h\} - \{f,g,h,a\} = \{b,c,d,e\}$

3. Taking the set of natural numbers as the universal set, write down the complement of the followingset:

(i) $\{x : x$ **is an even natural number}**

(ii) $\{x : x$ **is an odd natural number}**

(iii) $\{x : x$ **is a positive multiple of 3}**

(iv) $\{x : x$ **is a prime number}**

(v) $\{x : x$ **is a natural number divisible by 3 and 5}**

(vi) $\{x : x$ **is a perfect square}**

(vii) $\{x : x$ **is a perfect cube}**

(viii) $\{x : x + 5 = 8\}$

(ix) $\{x : 2x + 5 = 9\}$

(x) $\{x : x \geq 7\}$

(xi) $\{x : x \in \mathbf{N} \text{ and } 2a + 1 > 10\}$