EXERCISE 1.4

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

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

Solution:- (i) When X = {1, 3, 5} and Y = {1, 2, 3},

X ∪ Y = {1, 2, 3, 5}

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

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

A ∪ B = {a , b, c, e, i, o, u}

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

Solution:- (iii) A = { x : x is a natural number and multiple of 3} = {3, 6, 9....}

B = { x : x is a natural number less than 6} = {1, 2, 3, 4, 5}

Then A ∪ B = {1, 2, 4, 5, 3, 6, 9, 12....}

Therefore, A ∪ B = {x : x = 1, 2, 4, 5 or a multiple of 3}

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

Solution:- (iv) A = { x : x is a natural number and $1 < x \leq 6$ } = {2, 3, 4, 5, 6}

B = { x : x is a natural number and $6 < x < 10$ } = {7, 8, 9}

Then A ∪ B = {2, 3, 4, 5, 6, 7, 8, 9}

Therefore,

A ∪ B = {x : x ∈ N and $1 < x < 10$}

(v) A = {1, 2, 3}, B = φ

Solution:- (v) When A = {1, 2, 3} and B = Φ,

A ∪ B = {1, 2, 3}

2. Let A = { a, b }, B = {a, b, c}. Is A ⊂ B ? What is A ∪ B ?

Solution:- We say that A ⊂ B (which is read as "A is a subset of B") if every element of A is present in B.

Here,

A = {a, b} and B = {a, b, c}

We see that every element of A is present in B.

Hence, A ⊂ B.

A ∪ B is read as the "union of A and B" and it is the set formed with all elements of both A and B.

Thus,

A ∪ B = {a, b, c}

3. If A and B are two sets such that A ⊂ B, then what is A ∪ B ?

Solution:- A set is a well-defined collection of numbers, alphabets, objects, or any items.

A subset is a part of the set.

Set A is a subset of set B if all the elements in set A are present in set B.

Here,

A is called the subset, and B is called the superset.

If A and B are two sets such that A ⊂ B,

it means B consists all the elements of A.

Thus,

A ∪ 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 ∩ B

Solution:- **(i)** A ∪ B = {1, 2, 3, 4, 5, 6}

(ii) A ∪ C

Solution:- **(ii)** A ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}

(iii) B ∪ C

Solution:- **(iii)** B ∪ C = {3, 4, 5, 6, 7, 8}

(iv) B ∪ D

Solution:- **(iv)** B ∪ D = {3, 4, 5, 6, 7, 8, 9, 10}

(v) A ∪ B ∪ C

Solution:- **(v)** A ∪ B ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}

(vi) A ∪ B ∪ D

Solution:- **(vi)** A ∪ B ∪ D = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

(vii) B ∪ C ∪ D

Solution:- **(vii)** B ∪ C ∪ D = {3, 4, 5, 6, 7, 8, 9, 10}

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

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

(i) A ∩ B

(i) A ∩ B = {3, 4}

(ii) A ∩ C

Solution:- **(ii)** $A \cap C = \emptyset$

(iii) B ∩ C

Solution:- **(iii)** B ∩ C = {5, 6}

(iv) B ∩ D

Solution:- **(iv)** B ∩ D = ∅

(v) A ∩ B ∩ C

Solution:- **(v)** A ∩ B ∩ C = ∅

(vi) A ∩ B ∩ D

Solution:- **(vi)** A ∩ B ∩ D = ∅

(vii) B ∩ C ∩ D

Solution:- (vii) B ∩ C ∩ D=∅

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

(i) A ∩ B (ii) B ∩ C (iii) A ∩ C ∩ D (iv) A ∩ C (v) B ∩ D

(vi) A ∩ (B ∪ C) (vii) A ∩ D (viii) A ∩ (B ∪ D) (ix) (A ∩ B) ∩ (B ∪ C)

(x) (A ∪ D) ∩ (B ∪ C)

Solution:-

(i) A ∩ B = {7, 9, 11}

(ii) B ∩ C = {11, 13}

(iii) A ∩ C ∩ D = {A ∩ C} ∩ D

= {11} ∩ {15, 17}

= Φ

(iv) A ∩ C = {11}

(v) B ∩ D = Φ

(vi) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$= \{7, 9, 11\} \cup \{11\}$

$= \{7, 9, 11\}$

(vii) $A \cap D = \Phi$

(viii) $A \cap (B \cup D) = (A \cap B) \cup (A \cap D)$

$= \{7, 9, 11\} \cup \Phi$

$= \{7, 9, 11\}$

(ix) $(A \cap B) \cap (B \cup C) = \{7, 9, 11\} \cap \{7, 9, 11, 13, 15\}$

$= \{7, 9, 11\}$

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

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

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) $A \cap B$ (ii) $A \cap C$ (iii) $A \cap D$ (iv) $B \cap C$ (v) $B \cap D$ (vi) $C \cap D$

8. Which of the following pairs of sets are disjoint

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

Solution:-

(i) The first set is {1, 2, 3, 4}

The second set is {x : x is a natural number and $4 \leq x \leq 6$}

= {4, 5, 6}

Now,

$\{1, 2, 3, 4\} \cap \{4, 5, 6\} = \{4\} \neq \Phi$

Therefore, this pair of sets is NOT disjoint.

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

Solution:-

(ii) {a, e, i, o, u} ∩ {c, d, e, f} = {e} ≠ Φ

Therefore, this pair of sets are NOT disjoint.

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

Solution:-

(iii) {x : x is an even integer} ∩ {x : x is an odd integer} = Φ because there is no integer which can be both even and odd.

Therefore, this pair of sets is 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

Solution:- The given sets are:
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 }

Thus,

(i) A - B = {3, 6, 9, 15, 18, 21}

(ii) A - C = {3, 9, 15, 18, 21}

(iii) A - D = {3, 6, 9, 12, 18, 21}

(iv) B - A = {4, 8, 16, 20}

(v) C - A = {2, 4, 8, 10, 14, 16}

(vi) D - A = {5, 10, 20}

(vii) B - C = {20}

(viii) B - D = {4, 8, 12, 16}

(ix) C - B = {2, 6, 10, 14}

(x) D - B = {5, 10, 15}

(xi) C - D = {2, 4, 6, 8, 12, 14, 16}

(xii) D - C = {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

Solution:- The given sets are:

X= { a, b, c, d } and Y = { f, b, d, g}.

Thus,

(i) X - Y = {a, c}

(ii) Y - X = { f , g}

(ii) X ∩ Y = {b, d}

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

Solution:-It is given that

R: a set of real numbers

Q: a set of rational numbers

The difference between two sets A and B is a set denoted by A - B and is obtained by writing the elements of A that are NOT in B in a set.

Therefore,

R - Q is a set consiting of real numbers that are NOT rational.

i.e., R - Q is a set of irrational numbers

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

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

Solution:-(i) We have 3 ∈ {2, 3, 4, 5} and 3 ∈ {3, 6}

Therefore, {2, 3, 4, 5} ∩ {3, 6} = {3} and hence they are NOT disjoint.

Thus, the given statement is FALSE.

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

Solution:- (ii) We have a ∈ {a, e, i, o, u} and a ∈ {a, b, c, d}

Therefore, {a, e, i, o, u} ∩ {a, b, c, d} = {a} and hence they are NOT disjoint.

Thus, the given statement is FALSE.

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

Solution:- (iii) We have {2, 6, 10, 14} ∩ {3, 7, 11, 15} = Φ and hence they are disjoint.

Thus, the given statement is TRUE.

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

Solution: (iv) We have {2, 6, 10} ∩ {3, 7, 11} = Φ and hence they are disjoint.

Thus, the given statement is TRUE