EXERCISE 1.4

PAGE: 17

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

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

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

(iii) A = {*x*: *x* is a natural number and multiple of 3}

B = {*x*: *x* is a natural number less than 6}

(iv) A = {*x*: *x* is a natural number and 1 < *x* ≤ 6}

B = {*x*: *x* is a natural number and 6 < *x* < 10}

(v) A = {1, 2, 3}, B = Φ

Solution:

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

So the union of the pairs of set can be written as

X ∪ Y= {1, 2, 3, 5}

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

So the union of the pairs of set can be written as

A∪ B = {*a, b, c, e, i, o, u*}

(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, 6}

So the union of the pairs of set can be written as

A ∪ B = {1, 2, 4, 5, 3, 6, 9, 12 …}

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

(iv) A = {*x*: *x* is a natural number and 1 < *x* ≤ 6} = {2, 3, 4, 5, 6}

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

So the union of the pairs of set can be written as

A∪ B = {2, 3, 4, 5, 6, 7, 8, 9}

Hence, A∪ B = {*x*: *x* ∈ N and 1 < *x* < 10}

(v) A = {1, 2, 3}, B = Φ

So the union of the pairs of set can be written as

A∪ B = {1, 2, 3}

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

Solution:

It is given that

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

Yes, A ⊂ B

So the union of the pairs of set can be written as

A∪ B = {*a*, *b*, *c*} = B

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

Solution:

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

(ii) A ∪ C

(iii) B ∪ C

(iv) B ∪ D

(v) A ∪ B ∪ C

(vi) A ∪ B ∪ D

(vii) B ∪ C ∪ D

Solution:

It is given that

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

(i) A ∪ B = {1, 2, 3, 4, 5, 6}

(ii) A ∪ C = {1, 2, 3, 4, 5, 6, 7, 8}

(iii) B ∪ C = {3, 4, 5, 6, 7, 8}

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

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

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

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

5. Find the intersection of each pair of sets:

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

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

(iii) A = {*x*: *x* is a natural number and multiple of 3}

B = {*x*: *x* is a natural number less than 6}

(iv) A = {*x*: *x* is a natural number and 1 < *x* ≤ 6}

B = {*x*: *x* is a natural number and 6 < *x* < 10}

(v) A = {1, 2, 3}, B = Φ

Solution:

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

So the intersection of the given set can be written as

X ∩ Y = {1, 3}

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

So the intersection of the given set can be written as

A ∩ B = {*a*}

(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}

So the intersection of the given set can be written as

A ∩ B = {3}

(iv) A = {*x*: *x* is a natural number and 1 < *x* ≤ 6} = {2, 3, 4, 5, 6}

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

So the intersection of the given set can be written as

$A \cap B = \Phi$

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

So the intersection of the given set can be written as

$A \cap B = \Phi$

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) $A \cap B = \{7, 9, 11\}$

(ii) $B \cap C = \{11, 13\}$

(iii) $A \cap C \cap D = \{A \cap C\} \cap D$

$= \{11\} \cap \{15, 17\}$

$= \Phi$

(iv) $A \cap C = \{11\}$

(v) $B \cap D = \Phi$

(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 ∩ (B ∪ D) = (A ∩ B) ∪ (A ∩ D)

= {7, 9, 11} ∪ Φ

= {7, 9, 11}

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

= {7, 9, 11}

(x) (A ∪ D) ∩ (B ∪ C) = {3, 5, 7, 9, 11, 15, 17) ∩ {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

Solution:

It can be written as

A = {*x*: *x* is a natural number} = {1, 2, 3, 4, 5 …}

B ={*x*: *x* is an even natural number} = {2, 4, 6, 8 …}

C = {*x*: *x* is an odd natural number} = {1, 3, 5, 7, 9 …}

D = {*x*: *x* is a prime number} = {2, 3, 5, 7 …}

(i) A ∩B = {*x*: *x* is a even natural number} = B

(ii) A ∩ C = {*x*: *x* is an odd natural number} = C

(iii) A ∩ D = {*x*: *x* is a prime number} = D

(iv) B ∩ C = Φ

(v) B ∩ D = {2}

(vi) C ∩ D = {*x*: *x* is odd prime number}

8. Which of the following pairs of sets are disjoint?

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

(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}

Solution:

(i) {1, 2, 3, 4}

{*x*: *x* is a natural number and $4 \leq x \leq 6$} = {4, 5, 6}

So we get

{1, 2, 3, 4} ∩ {4, 5, 6} = {4}

Hence, this pair of sets is not disjoint.

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

Hence, {*a, e, i, o, u*} and (*c, d, e, f*} are not disjoint.

(iii) {*x*: *x* is an even integer} ∩ {*x*: *x* is an odd integer} = Φ

Hence, 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:

(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:

(i) X – Y = {*a, c*}

(ii) Y – X = {*f, g*}

(iii) 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:

We know that

R – Set of real numbers

Q – Set of rational numbers

Hence, 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.

(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.
Solution:

(i) False

If $3 \in \{2, 3, 4, 5\}$, $3 \in \{3, 6\}$

So we get $\{2, 3, 4, 5\} \cap \{3, 6\} = \{3\}$

(ii) False

If $a \in \{a, e, i, o, u\}$, $a \in \{a, b, c, d\}$

So we get $\{a, e, i, o, u\} \cap \{a, b, c, d\} = \{a\}$

(iii) True

Here $\{2, 6, 10, 14\} \cap \{3, 7, 11, 15\} = \Phi$

(iv) True

Here $\{2, 6, 10\} \cap \{3, 7, 11\} = \Phi$