RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.1

Sets Ex 1.1 Q1

Each set is a collection, but each collection need not be a set.
For example, a collection of beautiful women in Delhi is just a collection and not a set, for the term beautiful is not well defined. Only well defined collection of objects forms a set.

Sets Ex 1.1 Q2

(i) The collection of all natural numbers less than 50 forms a set as it is well defined.

(ii) It is not a set as the term 'good' is not well defined.

(iii) It forms a set as it is well defined.

(iv) It is not a set as the term 'most' is not well defined. A writer may be talented in the eye of one person, but he may not be talented in the eye of some other person.

(v) It is not a set as the term 'difficult' is not well defined.
A topic may be difficult for one person but may not be difficult for another person, so the term 'difficult' is vague.

(vi) It forms a set as it is well defined.

(vii) It forms a set as it is well defined.

(viii) It forms a set as it is well defined.

(ix) It is not a set as the term 'most dangerous' is not well defined.
The notion of dangerous animals differs from person to person.

(x) It forms a set as it is well defined.

Sets Ex 1.1 Q3

(i) $4 \in A$

(ii) $-4 \notin A$

(iii) $12 \notin A$

(iv) $9 \in A$

(v) $0 \in A$

(vi) $-2 \notin A$

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces $\{\ \}$. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

The above set in Roster form can be written as $\{a, b, c, d,\}$. Since the letters $a, b, c,$ and d precedes e in the english alphabet.

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.2

Sets Ex 1.2 Q1(ii)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces $\{\ \}$. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

$1 \in N \ \because \ 1^2 = 1 < 25$

$2 \in N \ \because 2^2 = 4 \ < 25$

$3 \in N \ \because 3^2 = 9 \ < 25$

$4 \in N \ \because 4^2 = 16 \ < 25$

Hence , the above set can be written as $\{1, 2, 3, 4\}$

Sets Ex 1.2 Q1(iii)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces $\{\ \}$. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

We note that $a < x < b$ means tha x is more than a but less than b.

The prime numbers which are more than 10 fact less than 20 are 11,13,17 and 19.

Hence the above set can be written as $\{11, 13, 17, 19\}$

Sets Ex 1.2 Q1(iv)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

The above set can be written as $\{2,4,6,8...\}$ since all those natural numbers, which can be written as a multiple of 2 are the even natural numbers.

Sets Ex 1.2 Q1(v)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

We know that given any $x \in R$, x is always less than or equal to itself, i.e $x \le x$
Hence the above set is empty, i.e ϕ.

Sets Ex 1.2 Q1(vi)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

The Prime divisors of 60 are 2,3,5.
Hence the above set can be written as $\{2,3,5\}$

Sets Ex 1.2 Q1(vii)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

The above set can be written as
$\{17,26,35,44,53,62,71,80\}$

Sets Ex 1.2 Q1(viii)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

As repetition is not allowed in a set, the distinct letters are T,R,I,G,O,N,M,E,Y.
Hence the above set can be written as

$$\{T,R,I,G,O,N,M,E,Y\}$$

Sets Ex 1.2 Q1(ix)

In Roster form, we describe a set by listing its elements, reparated by commas and the elements are written within braces { }. If a set has infinitely many elements, them comma is followed by ..., where the dots stand for 'and so on'.

The distinct letters are B,E,T,R.

Hence the set can be written as

$$\{B,E,T,R.\}$$

Sets Ex 1.2 Q2(i)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

So, the above set A in Set-Builder form may be written as

$$A = \{x \in N : x < 7\}$$

i.e A is the set of natural numbers x such that x is less than 7.

or

$$A = \{x \in N | 1 \le x \le 6\},$$

Sets Ex 1.2 Q2(ii)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

$$B = \left\{x : x = \frac{1}{n}, n \in N\right\}$$

i.e B is the set of all those x such that $x = \frac{1}{n}$, where $n \in N$

Sets Ex 1.2 Q2(iii)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

$C = \{x : x = 3k,\ k \in Z^+, \text{the set of positive integers}\}$,

i.e C is the set of multiples of 3 including 0

Sets Ex 1.2 Q2(iv)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

$D = \{x \in N : 9 < x < 16\}$,

i.e D is the set of natural numbers which are more than 9 but less than 16.

Sets Ex 1.2 Q2(v)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

$E = \{x \in Z : -1 < x < 1\}$

or

$E = \{x \in Z : x = 0\}$

Sets Ex 1.2 Q2(vi)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

As $1^2 = 1$

$2^2 = 4$

$3^2 = 9$

$10^2 = 100$

$\therefore$ The above set may be described as

$\{x^2 : x \in N \ \& \ 1 \le x \le 10\}$

Sets Ex 1.2 Q2(vii)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

The given set can be described as

$\{x : x = 2n, n \in N\}$ ($\because$ 2, 4, 6, ... are multiples of 2)

Sets Ex 1.2 Q2(viii)

In set Builder form, a set is described by some characterizing property $P(x)$ of its elements x.

In this case a set can be described as $\{x : P(x) \text{hold}\}$ or $\{x | P(x) \text{holds}\}$ which is read as 'the set of all x such that $P(x)$ holds'.

The symbols ':' or 'I' is read as 'such that'.

$\because 5^1 = 5$

$5^2 = 25$

$5^3 = 125$

$5^4 = 625$

$\therefore$ The above set can be described as

$\{x : x = 5^n, 1 \le n \le 4\}$

Sets Ex 1.2 Q3(i)

The integers whose squares are less than or equal to 10 are:

$(-3)^2 = 9 < 10$

$(-2)^2 = 4 < 10$

$(-1)^2 = 1 < 10$

$0^2 = 0 < 10$

$1^2 = 1 < 10$

$2^2 = 4 < 10$

$3^2 = 9 < 10$

The square of other integers are more than 10

Hence $A = \{0, \pm 1, \pm 2, \pm 3\}$

or

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

Sets Ex 1.2 Q3(ii)

Let's find the values of $x = \frac{1}{2n-1}$, for $1 \le n \le 5$

for $n = 1, x = \frac{1}{1} = 1$

for $n = 2$, $x = \frac{1}{2 \times 2 - 1} = \frac{1}{4-1} = \frac{1}{3}$

for $n = 3$, $x = \frac{1}{2 \times 3 - 1} = \frac{1}{6-1} = \frac{1}{5}$

for $n = 4$, $x = \frac{1}{2 \times 4 - 1} = \frac{1}{8-1} = \frac{1}{7}$

for $n = 5$, $x = \frac{1}{2 \times 5 - 1} = \frac{1}{10-1} = \frac{1}{9}$

Hence, $B = \left\{1, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}\right\}$

Sets Ex 1.2 Q3(iii)

Hence $C = \{0,1,3,4,\}$

Sets Ex 1.2 Q3(iv)

The vowels in the word EQUATION are E, U, A, I, O.

Since the order in which the elements of a set are written is unmaterial, $D = \{A, E, I, O, U\}$

Sets Ex 1.2 Q3(v)

A month has either 28, 29, 30 or 31 days.

Out of the 12 months in a year , the months that have 31 days are:
January, March, May, July, August, October, December.

$\therefore E$ = {February, April, June, September, November}

Sets Ex 1.2 Q3(vi)

The distinct letters of the word 'MISSISSIPPI' are M, I, S, P

Hence $F = \{M, I, S, P\}$

Sets Ex 1.2 Q4

(i) $\{A, P . L, E\} \leftrightarrow \{x : x$ is a letter of the word "APPLE"$\}$

(ii) The solution set of $x^2 - 25 = 0$ is $x = \pm 5$

Hence, $\{-5, 5\} \leftrightarrow \{x : x^2 - 25 = 0\}$

(iii) The solution set of $x + 5 = 5$ is $x = 0$

Hence, $\{0\} \leftrightarrow \{x : x + 5 = 5, x \in Z\}$

(iv) The natural numbers which are divisor of 10 are 1, 2, 5, 10

Hence, $\{1, 2, 5, 10\} \leftrightarrow \{x : x$ is a natural number and divisor of 10$\}$

(v) The distinct letters of the word "RAJASTHAN" are A, H, J, R, S, T, H

Hence, $\{A, H, J, R, S, T, N\} \leftrightarrow \{x : x$ is a letter of the word "RAJASTHAN"$\}$

(vi) The prime natural numbers which are divisor of 10 are 2, 5

Hence, $\{2, 5\} \leftrightarrow \{x : x$ is a prime natural number and a divisor of 10$\}$

Sets Ex 1.2 Q5

The vowels which precede q, that is, come before q are a, e, i, o

Hence the set of vowels in the English alphabet which precede q are

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

Sets Ex 1.2 Q6

As the cube of an odd integer is odd, and an odd positive integer has the form $2n + 1$ for some $n \geq 0$,

Hence the set of all positive integers whose cube is odd may be written in set builder form as $\{x \in Z, x = 2n + 1, n \geq 0\}$

Sets Ex 1.2 Q7

As $2 = 1^2 + 1$

$5 = 2^2 + 1$

$10 = 3^2 + 1$

:

:

$50 = 7^2 + 1$

So, the above set in set builder form can be written as

$$\left\{\frac{n}{n^2 + 1} : n \in N, 1 \leq n \leq 7\right\}$$

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.3

Sets Ex 1.3 Q1

(i) This set is non-empty as 10 is an even natural number divisible by 5.

(ii) As 2 belongs to this set, so it is non-empty.

(iii) $x^2 - 2 = 0 \Rightarrow x^2 = 2 \Rightarrow x = \pm\sqrt{2} \notin Q$, the set of rational numbers
So, this set is empty.

(iv) This set is empty as there is no natural number x such that $x < 8$ and simultaneously $x > 12$.

(v) This set is empty as any two parallel lines never intersect each other.

Sets Ex 1.3 Q2

(i) Infinite, since with a common centre infinitely many circles can be drawn in a plane.

(ii) Finite, as there are only 26 letters of English Alphabet.

(iii) Infinite, $\because$ $\{x \in N : x > 5\} = \{6, 7, 8, \ldots\}$ Which is infinite.

(iv) Finite, $\because \{x \in N : x, 200\} = \{1, 2, 3, \ldots 199\}$ Which is finite.

(v) Infinite, $\because$ $\{x \in Z : x < 5\} = -\{\ldots, -3, -2, -1, 0, 1, 2, 3, 4,\}$ Which is infinite.

(vi) $\{x \in R : 0 < x < 1\}$ is an infinite set $\because$ an interval is an infinite set.

Sets Ex 1.3 Q3

$A = \{1, 2, 3\}$

$B = \left\{x \in R : (x-1)^2 = 0\right\}$

$= \{x \in R : x = 1, 1\}$

$= \{1\}$

$C = \{1, 2, 3\}$ ($\because$ repetition is not allowed in a set)

$D = \left\{x \in R : x^3 - 6x^2 + 11x - 6 = 0\right\}$

$= \left\{x \in R : (x-1)\left(x^2 5x + 6\right) = 0\right\}$ [$\because$ $x = 1$ satisfies the above equation]

$= \{x \in R : (x-1)(x-2)(x-3) = 0\}$

$= \{x \in R : x = 1, 2, 3\}$

$= \{1, 2, 3\}$

Hence the set A, C and D are equal.

Sets Ex 1.3 Q4

$A = \{a, e, p, r\}$

$B = \{a, e, p, r\}$ (repetition of 'p' is not allowed)

$C = \{e, o, p, r\}$

as $A = B \neq C$, $\therefore$ the sets are not equal

Sets Ex 1.3 Q5

Two finite sets are said to be equivalent if they have the same number of elements.
As A and C have same number of elements, and B and D also have same number of elements.

$\therefore$ A is equivalent to C & B is equivalent to D.

Sets Ex 1.3 Q6

(i)

Two sets A and B are said to be equal if every elements of A is an elements of B and vice-versa.

We have, $A = \{2, 3\}$

and $B = \left\{x : x \text{ is a solution of } x^2 + 5x + 6 = 0\right\}$

$= \left\{x : x^2 + 3x + 2x + 6 = 0\right\}$

$= \{x : x(x+3) + 2(x+3 = 0)\}$

$= \{x : (x+3)(x+2) = 0\}$

$= \{x : x = -2, -3\}$

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

Hence $A \neq B$.

(ii)

$A = \{W, O, L, F\}$

$B = \{F, O, L, W\}$ [$\because$ repetition is not allowed]

$= \{W, O, LF\}$ [The order in which the elements are written does not matter.]

Hence $A = B$

Sets Ex 1.3 Q7

$A = \{0, a\}$

$B = \{1, 2, 3, 4,\}$

$C = \{4, 8, 12\}$

$D = \{3, 1, 2, 4\}$

$= \{1, 2, 3, 4\}$

$E = \{1, 0\}$

$F = \{8, 4, 12\}$

$\quad = \{4, 8, 12\}$

$G = \{1, 5, 7, 11\}$

$H = \{a, b\}$

The sets B and D are equal.

The sets C and F are equal.

As A, E and H have same number of elements so they are equivalent.

As B, D and G have same number of elements, so they are equivalent

Also C and F have same number of elements, so they are equivalent.

Sets Ex 1.3 Q8

$A = \{1, 2\}$

$B = \{1, 2\}$

$C = \{3, 1\}$

$D = \{1, 3\}$ $\quad [\because$ the odd natural numbers less than 5 are 1 and 3$]$

$E = \{1, 2\}$ $\quad [\because$ repetition is not allowed$]$

$F = \{1, 3\}$ $\quad [\because$ repetition is not allowed$]$

$\therefore \quad A, B$ and E are equal

Aslo, C, D and F are equal

Sets Ex 1.3 Q9

The set formed by distinct letters of the word "CATARACT" are $\{C, A, T, R\}$.

The set formed by distinct letters of the word "TRACT" are $\{T, R, A, C\}$

Hence the two set are equal.

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.4

Sets Ex 1.4 Q1

(i) False, $\because$ the two sets A and B need not be comparable.

(ii) False, $\because$ $\{1\}$ is a finite subset of the infinite set N of natural numbers.

(iii) True, $\because$ the order (or cardinal number) of any subset of a set is less than or equal to the order of the set.
(order (or cardinal number) of a set is the number of elements in the set).

(iv) False, $\because$ the empty set ϕ has no proper subset.

(v) False, $\because$ $\{a,b,a,b,...\} = \{a,b\}$ (repetition is not allowed)

$\therefore$ $\{a,b,a,b,...\}$ is a finite set.

(vi) True, $\because$ equivalent sets have the same cardinal number.

(vii) False,
One knows that if the cardinal number of a set A is n, then the power set of A denoted by $P(A)$ which is the set of all subsets of A, has the cardinal number 2^n.

If the cardinal number of A is infinite, then the cardinal number of $P(A)$ is also infinite.
Hence, the above statement is true provided the set is infinite.

Sets Ex 1.4 Q2

(i) True, $\because$ 1 is an element of the set $\{1,2,3\}$.

(ii) False, $\because$ a is an element and not a subset of the set $\{b,c,a\}$.

(iii) False, $\because$ $\{a\}$ is a subset of the set $\{a,b,c\}$ and not an element.

(iv) True, $\because$ repetition is not allowed in a set.

(v) False, $\because$ the set $\{x : x + 8 = 8\}$ is the single ton set $\{0\}$ which is not the null set ϕ.

Sets Ex 1.4 Q3

We have,

$$A = \{x : x \text{ satisfies } x^2 - 8x + 12 = 0\}$$
$$= \{x : x^2 - 6x - 2x + 12 = 0\}$$
$$= \{x : x(x-6) - 2(x-6) = 0\}$$
$$= \{x : (x-6)(x-2) = 0\}$$

$= \{x : x = 6, 2\}$
$= \{6, 2\}$

$B = \{2, 4, 6\}$
$C = \{2, 4, 6, 8, \ldots\}$
$D = \{6\}$

We know that if E and F are two sets, then E is a subset of F. i.e., $E \subseteq F$ if $x \in E \Rightarrow x \in F$. E is called a proper subset of F if E is strictly contained in F and is denoted by $E \subset F$.

Clearly,
$D \subset A \{\because 6 \in D \text{ and } 6 \in A\}$
$A \subset B \{\because 2,6 \in A \text{ and they also belong to } B\}$
Similarly, $B \subset C$

Hence, $D \subset A \subset B \subset C$.

Sets Ex 1.4 Q4(i)

The given statement is 'True'.

If $m \in z$, then m can be written as $\frac{m}{1}$, which is of the form $\frac{p}{q}$, where p and q are relatively prime integers and $q \neq 0$.

This implies that $m \in Q$, the set of rational numbers.

Thus, $m \in z \Rightarrow m \in Q$

Hence $Z \subseteq Q$

Sets Ex 1.4 Q4(ii)

The given statement is 'True'.
$\because$ Crows are also Birds.

Sets Ex 1.4 Q4(iii)

The given statement is 'False'.
$\because$ A rectangle need not be a square.

Sets Ex 1.4 Q4(iv)

The given statement is 'True'.

If z is a complex number, then it can be written as $z = x + iy$, where x and y are real numbers and are called the real and imaginary parts of the complex number z.

If x is a real number, then
$x = x + i.0 \in C$,
where C is the set of complex numbers.

Thus $x \in R \Rightarrow x \in C$

Hence, the set of all real numbers is contained in the set of all complex numbers.

Sets Ex 1.4 Q4(v)

False, $\because$ $a \in P$ but $a \notin B$
Note that $\{a\}$ is an element of B which is different from the element 'a'.

Sets Ex 1.4 Q4(vi)

$A = \{L,I,T,E\}$ [$\because$ repetition is not allowed]
$B = \{T,I,L,E\}$ [$\because$ repetition is not allowed]
$= \{L,I,T,E\}$ [$\because$ the manner in which the elements are listed does not matter]

$\because$ Each element of A is an element of B and vice-versa

$\therefore$ $A = B$

Hence, the given statement is true.

Sets Ex 1.4 Q5

(i) False,
The correct statement is $a \in \{a, b, c\}$.

The correct form is $\{a\} \subset \{a,b,c\}$.

(iii) False, $\because$ a is not an element of $\{\{a\},b\}$

The correct form is $\{a\} \in \{\{a\},b\}$

(iv) False, $\because \{a\}$ is not a subset of $\{\{a\},b\}$ hence it cannot be contained in it.

The correct form is $\{a\} \in \{\{a\},b\}$. Another correct form could be $\{\{a\}\} \subset \{\{a\},b\}$.

(v) False, $\because$ $\{b,c\}$ is an element and not a subset of $\{a,\{,bc\}\}$.

The correct form is $\{b,c\} \in \{a,\{b,c\}\}$.

(vi) False, $\because$ $\{a,b\}$ is not a subset of $\{a,\{b,c\}\}$

The correct form is $\{a,b\} \not\subset \{a,\{b,c\}\}$.

(vii) False, $\because$ ϕ is not an element of $\{a,b\}$.

The correct form is $\phi \subset \{a,b\}$.

(viii) True, $\because$ empty set ϕ is a subset of every set.

(ix) False, $\because \{x : x+3=3\} = \{x : x=0\} = \{0\}$

The correct form is $\{x : x+3=3\} \neq \phi$.

Sets Ex 1.4 Q6

(i) False, $\{c,d\}$ is an element of A and not a subset of A.

(ii) True, $\because \{c,d\}$ is indeed an element of A.

(iii) True, $\because \{c,d\}$ is a subset of A.

(iv) True,

(v) False, $\because$ a belongs to A and not a subset of A. An element of a set belongs to it whereas a subset of it is contained in it.

(vi) True, $\because \{a,b,e\}$ is a subset of A.

(vii) False, $\because \{a,b,e\}$ is a subset of A, so it does not belong to A.

(viii) False, $\because \{a,b,c\}$ is not a subset of A.

(ix) False, $\because \phi$ is a subset and not an element of A.

(x) False, $\because \phi$ and not $\{\phi\}$ is a subset of A.

Sets Ex 1.4 Q7

(i) False, $\because$ 1 is not an element of A.

(ii) False, $\because \{1,2,3\}$ is not a subset of A, it is an element of A.

(iii) True, $\because \{6,7,8\}$ is indeed an element of A.

(iv) True, $\because$ $\{\{4,5\}\}$ is indeed a subset of A.

(v) False, $\because$ ϕ is a subset and not an element of A.

(vi) True, $\because$ ϕ is a subset of every set, and hence a subset of A.

Sets Ex 1.4 Q8

(i) True, $\because$ ϕ indeed belongs to A.

(ii) True, $\because$ $\{\phi\}$ is an element of A.

(iii) False, $\because$ $\{1\}$ is not an element of A.

(iv) True, $\because$ $\{2,\phi\}$ is a subset of A.

(v) False, $\because$ 2 is not a subset of A, it

(vi) True, $\because \{2,\{1\}\}$ is not a subset of

(vii) True, $\because$ $\{\{2\},\{1\}\}$ is not a subset of A.

(viii) True, $\because \{\phi,\{\phi\},\{1,\phi\}\}$ is a subset of A.

(ix)True, $\because \{\{\phi\}\}$ is a subset of A.

Sets Ex 1.4 Q9

(i) We know that, if a set has n elements, then its power set has 2^n elements.

Here, $n = 1$, so there $2^1=2$ subsets of the given set.

The possible subsets are $\phi,\{a\}$.

(ii) The set has two elements, so power set has $2^2 = 4$ elements, namely $\phi,\{0\},\{1\},\{0,1\}$.

(iii) The set has 3 elemets , so power set has $2^3 = 8$ elements,
namely $\phi,\{a\},\{b\},\{c\},\{a,b\},\{b,c\},\{a,c\},\{a,b,c\}$.

(iv) The set has 2 elements, so power set has $2^2 = 4$ elements, namely, $\phi,\{1\},\{\{1\}\},\{1,\{1\}\}$.

(v) The set has 1 element, so power set has $^1 = 2$ elements, namely $\phi,\{\phi\}$.

Sets Ex 1.4 Q10

(i) We know that if A is a set and B a subset of A, then B is called a proper subset of A
if $B \subseteq A$ and $B \neq A$, ϕ and is written as $B \subset A$ or $B \subseteq A$.

Hence, the proper subsets are given by $\{1\},\{2\}$.

(ii) The proper subsets are given by $\{1\},\{2\},\{3\},\{1,2\},\{2,3\},\{1,3\}$.

(iii) The only subsets of the given set are ϕ & $\{1\}$.
Hence, there are no proper subsets.

Sets Ex 1.4 Q11

We know that, if A is a set having n elements then power set of A,
namely $P(A)$ has 2^n elements. Out of this A is not proper subset.

Hence, the total number of proper subsets of a set consisting of n elements in $2^n - 1$

Sets Ex 1.4 Q12

The symbol '$\Leftrightarrow$' stands for if and only if (in short iff).
In order to show that two sets A and B are equal we show that $A \subseteq B$ and $B \subseteq A$.

We have $A \subseteq \phi$. $\because$ ϕ is a subset of every set

$\therefore$ $\phi \subseteq A$

Hence $A = \phi$
To show the backward implication, suppose that $A = \phi$
$\because$ every set is a subset of itself
$\therefore$ $\phi = A \subseteq \phi$

Hence, proved.

Sets Ex 1.4 Q13

We have $A \subseteq B$, $B \subseteq C$ and $C \subseteq A$, so $A \subseteq B \subseteq C \subseteq A$
Now, A is a subset of B and B is a subset of C, so

A is a subset of C, i.e., $A \subseteq C$

Also, $C \subseteq A$

Hence, $A = C$

Sets Ex 1.4 Q14

$\because$ an empty set has zero element.

$\therefore$ power set of ϕ has $2^0 = 1$ element.

Sets Ex 1.4 Q15

(i)

The set of right triangles is a subset of the set of all triangles in the plane. So, the set of all triangles in the plane forms a universal set for the set of right triangles.

(ii)

The set of isosceles triangles forms a subset of the set of all triangles in the plane.

Hence the set of all triangles in the plane forms a universal set for the set of isosceles triangles.

Sets Ex 1.4 Q16

$$X = \{8^n - 7n - 1 : x \in N\}$$
$$Y = \{4n(n-1) : n \in N\}$$

In order to show that $x \subseteq y$ we show tat every element of X is an element of Y.

So let $x \in X \Rightarrow x = 8^m - 7m - 1$ for some $m \in N$

$$\Rightarrow \quad x = (1+7)^m - 7m - 1$$
$$= \left({}^mC_0 1^m + {}^mC_1 1^{m-1} 7 + \ldots + {}^mC_{m-1} 1^1 7^{m-1} + {}^mC_m 7^m\right) - 7m - 1$$

[using binomial expansion]

$$= 1 + 7m + {}^mC_2 7^2 + {}^mC_3 7^3 + \ldots + {}^mC_m 7^m - 7m - 1$$
$$= {}^mC_2 7^2 + {}^mC_3 7^3 + \ldots + {}^mC_m 7^m$$
$$= 49\left({}^mC_2 + {}^m mC_3 + \ldots + {}^mC_m 7^{m-2}\right), \; m \geq 2$$
$$= 49t_m, \; m \geq 2, \text{ where } t_m = {}^mC_2 + {}^mC_3 7 + \ldots + {}^mC_m 7^{m-2}$$

Is some positive integer depending on $m \geq 2$

For $m = 1$

$$x = 8^1 - 7 \times 1 - 1$$
$$= 8 - 8$$
$$= 0$$

Hence, X contains all positive integral multiples of 49.

Also, Y consistes of all positive integral multiples of 49, including 0, for $n = 1$.

Thus, we conclude that $X \subseteq Y$.

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.5

Sets Ex 1.5 Q1

(i)

$A \cap B$ denotes intersection of the two sets A and B, which consists of elements which are common to both A and B.

Since $A \subset B$, every element of A is already an element of B.

$\therefore A \cap B = A$

(ii)

$A \cup B$ denotes the union of the sets A and B which consists of elements which are either in A or B or in both A and B.

Since $A \subset B$, every element of A is already an element of B.

$\therefore A \cup B = B$

Sets Ex 1.5 Q2(i)

$A = \{1, 2, 3, 4, 5\}$

$B = \{4, 5, 6, 7, 8\}$

So, $A \cup B = \{x : x \in A \text{ or } x \in B\}$

Sets Ex 1.5 Q2(ii)

$A \cup C = \{x : x \in A \text{ or } x \in C\}$

$= \{1, 2, 3, 4, 5, 7, 8, 9, 10, 11\}$

Sets Ex 1.5 Q2(iii)

$B \cup C = \{x : x \in B \text{ or } x \in C\}$

$= \{4, 5, 6, 7, 8, 9, 10, 11\}$

Sets Ex 1.5 Q2(iv)

$B \cup D = \{x : x \in B \text{ or } x \in D\}$

$= \{4, 5, 6, 7, 8, 10, 11, 12, 13, 14\}$

Sets Ex 1.5 Q2(v)

$A \cup B \cup C = \{x | x \in A \text{ or } x \in B \text{ or } x \in C\}$

$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$

Sets Ex 1.5 Q2(vi)

$A \cup B \cup D = \{x : x \in A \text{ or } x \in B \text{ or } x \in D\}$

$= \{1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14\}$

Sets Ex 1.5 Q2(vii)

$B \cup C \cup D = \{x | x \in B \text{ or } x \in C \text{ or } x \in D\}$

$= \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14\}$

Sets Ex 1.5 Q2(viii)

$A \cap (B \cup C)$ = all those elements which are common to A and $B \cup C$

$= \{x | x \in A \text{ and } x \in B \cup C\}$

Now, $B \cup C = \{4, 5, 6, 7, 8, 9, 10, 11\}$

$\therefore \ A \cap (B \cup C) = \{1, 2, 3, 4, 5\} \cap \{4, 5, 6, 7, 8, 9, 10, 11\}$

$= \{4, 5\}$

Sets Ex 1.5 Q2(ix)

$(A \cap B) \cap (B \cap C) = \{x | x \in (A \cap B) \text{ and } x \in (B \cap C)\}$

Now,

$A \cap B = \{x | x \in A \text{ and } x \in B\}$

i.e., elements which are common to A & B

$\therefore \ A \cap B = \{1, 2, 3, 4, 5\} \cap \{4, 5, 6, 7, 8\}$

$= \{4, 5\}$

Also,

$B \cap C = \{4, 5, 6, 7, 8\} \cap \{7, 8, 9, 10, 11\}$

$= \{7, 8\}$

Hence, $(A \cap B) \cap (B \cap C) = \{4, 5\} \cap \{7, 8\}$

$= \phi$ $\quad \left[\because \text{ there is no element common in } \{4, 5\} \text{ and } \{7, 8\}\right]$

Sets Ex 1.5 Q2(x)

$(A \cup D) \cap (B \cup C) = \{x | x \in (A \cup D) \text{ or } x \in (B \cup C)\}$

Now,

$A \cup D = \{1, 2, 3, 4, 5, 10, 11, 12, 13, 14\}$

and $\quad B \cup C = \{4, 5, 6, 7, 8, 9, 10, 11\}$

$\therefore \ (A \cup D) \cap (B \cup C) = \{4, 5, 10, 11\}$

Sets Ex 1.5 Q3(i)

We have,

$A = \{x : x \in N\}$

$= \{1, 2, 3, \ldots\}$, the set of natrual numbers

$B = \{x : x = 2n, x \in N\}$

$= \{2, 4, 6, 8, \ldots\}$, the set of even natural numbers

$\therefore \ A \cap B = \{x : x \in A \text{ and } x \in B\}$

$= \{2, 4, 6, \ldots\}$

$= B \quad [\because B \subset A]$

Sets Ex 1.5 Q3(ii)

$A = \{x : x \in N\}$
$= \{1, 2, 3, \ldots\}$, the set of natrual numbers

$C = \{x : x = 2n - 1, x \in N\}$
$= \{1, 3, 5, \ldots\}$, the set of odd natural numbers

$A \cap C = \{x : x \in A \text{ and } x \in C\}$
$= C \qquad [\because C \subset A]$

Sets Ex 1.5 Q3(iii)

We have,

$A = \{x : x \in N\}$
$= \{1, 2, 3, \ldots\}$, the set of natrual numbers

and $D = \{x : x \text{ is a prime natural number}\}$
$= \{2, 3, 5, 7, \ldots\}$

$A \cap D = \{x : x \in A \text{ and } x \in D\}$
$= D \qquad [\because D \subset A]$

Sets Ex 1.5 Q3(iv)

We have,

$B = \{x : x = 2n, x \in N\}$
$= \{2, 4, 6, 8, \ldots\}$, the set of even natural numbers

and

$C = \{x : x = 2n - 1, x \in N\}$
$= \{1, 3, 5, \ldots\}$, the set of odd natural numbers

$B \cap C = \{x : x \in B \text{ and } x \in C\}$
$= \phi$ [$\because$ B and C are disjoint sets, i.e., have no elements in common]

Sets Ex 1.5 Q3(v)

Here,

$B = \{x : x = 2n, x \in N\}$
$= \{2, 4, 6, 8, \ldots\}$, the set of even natural numbers

and $D = \{x : x \text{ is a prime natural number}\}$
$= \{2, 3, 5, 7, \ldots\}$

$B \cap D = \{x : x \in B \text{ and } x \in D\}$
$= \{2\}$

Sets Ex 1.5 Q3(vi)

Here,

$C = \{x : x = 2n - 1, x \in N\}$
$= \{1, 3, 5, \ldots\}$, the set of odd natural numbers

and $D = \{x : x \text{ is a prime natural number}\}$
$= \{2, 3, 5, 7, \ldots\}$

$C \cap D = \{x : x \in C \text{ and } x \in D\}$

We observe that except, the element 2, every other element in D is an odd natural number.

Hence, $C \cap D = D - \{2\}$
$= \{x \in D : x \neq 2\}$

Sets Ex 1.5 Q4

We have,

We have,

A =

B =

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

$D = \{5, 10, 15, 20\}$

If A and B are two sets, then the set $A - B$ is defined as

$A - B = \{x \in A : x \notin B\}$.

(i) $A - B = \{x \in A : x \notin B\} = \{3, 6, 15, 18, 21\}$

(ii) $A - C = \{x \in A : x \notin C\} = \{3, 15, 18, 21\}$

(iii) $A - D = \{x \in A : x \notin D\} = \{3, 6, 12, 18, 21\}$

(iv) $B - A = \{x \in B : x \notin A\} = \{4, 8, 16, 20\}$

(v) $C - A = \{x \in C : x \notin A\} = \{2, 4, 8, 10, 14, 16\}$

(vi) $D - A = \{x \in D : x \notin A\} = \{5, 10, 20\}$

(vii) $B - C = \{x \in B : x \notin C\} = \{20\}$

(viii) $B - D = \{x \in B : x \notin D\} = \{4, 8, 12, 16\}$

Sets Ex 1.5 Q5

(i)

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$, $C = \{3, 4, 5, 6\}$

By the complement of a set A, which respect to the universal set U, denoted by A' or A^c or $U - A$, we mean $\{x \in U : x \notin A\}$.

Hence, $A' = \{x \in U : x \notin A\} = \{5, 6, 7, 8, 9\}$

(ii) $B' = \{x \in U : x \notin B\} = \{1, 3, 5, 7, 9\}$

(iii) $(A \cap C)' = \{x \in U : x \notin A \cap C\}$

Now,

$A \cap C = \{x : x \in A \text{ and } x \in C\} = \{3, 4\}$

$\therefore \ (A \cap C)' = \{1, 2, 5, 6, 7, 8, 9\}$

Sets Ex 1.5 Q6

(i)

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$A = \{2, 4, 6, 8\}$

$B = \{2, 3, 5, 7\}$

We have,

$A \cup B = \{x : x \in A \text{ or } x \in B\}$

$= \{2, 3, 4, 5, 6, 7, 8\}$

$\therefore (A \cup B)' = \{x \in U : x \notin A \cup B\}$

$= \{1, 9\}$

$A' = \{x \in U : x \notin A\}$

$= \{1, 3, 5, 7, 9\}$

$B' = \{x \in U : x \notin B\}$

$= \{1, 4, 6, 8, 9\}$

Hence, $A' \cap B' = \{1, 9\}$

Hence, $(A \cup B)' = A' \cap B' = \{1, 9\}$

(ii)

$A \cap B = \{x : x \in A \text{ and } x \in B\}$

$= \{2\}$

$\therefore \quad (A \cap B)' = \{x \in U : x \notin A \cap B\}$

$= \{1, 3, 4, 5, 6, 7, 8, 9\}$

Also,

$A' \cup B' = \{x : x \in A' \text{ or } x \in B'\}$

$= \{1, 3, 4, 5, 6, 7, 8, 9\}$

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

RD Sharma Solutions Class 11 Maths Chapter Ex 1.6

Sets Ex 1.6 Q1

The smallest set A such that

$A \cup \{1,2\} = \{1,2,3,5,9\}$ is $\{3,5,9\}$

$\because \quad \{3,5,9\} \cup \{1,2\} = \{1,2,3,5,9\}$

Any other set B such that $B \cup \{1,2\} = \{1,2,3,5,9\}$ will contain A. For example we contake B to be $\{1,3,5,9\}$ or $\{1,2,3,5,9\}$.
Clearly B contains $A = \{3,5,9\}$.

Sets Ex 1.6 Q2(i)

i. $A = \{1,2,4,5\}, B = \{2,3,5,6\}, C = \{4,5,6,7\}$

$B \cap C = \{5,6\}$

$A \cup (B \cap C) = \{1,2,4,5,6\} \ldots\ldots\ldots (1)$

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

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

$(A \cup B) \cap (A \cup C) = \{1,2,4,5,6\} \ldots\ldots\ldots\ldots (2)$

From eq^n (1) and eq^n (2), we get

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

Sets Ex 1.6 Q2(ii)

ii. $A = \{1,2,4,5\}, B = \{2,3,5,6\}, C = \{4,5,6,7\}$

$B \cup C = \{2,3,4,5,6,7\}$

$A \cap (B \cup C) = \{2,4,5\} \ldots\ldots\ldots (1)$

$(A \cap B) = \{2,5\}$

$(A \cap C) = \{4,5\}$

$(A \cap B) \cup (A \cap C) = \{2,4,5\} \ldots\ldots\ldots\ldots (2)$

From eq^n (1) and eq^n (2), we get

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

Sets Ex 1.6 Q2(iii)

iii. $A = \{1,2,4,5\}, B = \{2,3,5,6\}, C = \{4,5,6,7\}$

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

$A \cap (B - C) = \{2\} \ldots\ldots\ldots (1)$

$(A \cap B) = \{2,5\}$

$(A \cap C) = \{4,5\}$

$(A \cap B) - (A \cap C) = \{2\} \ldots\ldots\ldots\ldots (2)$

From eq^n (1) and eq^n (2), we get

$A \cap (B - C) = (A \cap B) - (A \cap C)$

Sets Ex 1.6 Q2(iv)

iv. $A = \{1,2,4,5\}, B = \{2,3,5,6\}, C = \{4,5,6,7\}$

$B \cup C = \{2,3,4,5,6,7\}$

$A - (B \cup C) = \{1\} \ldots\ldots\ldots (1)$

$(A - B) = \{1,4\}$

$(A - C) = \{1,2\}$

$(A - B) \cap (A - C) = \{1\} \ldots\ldots\ldots\ldots (2)$

From eq^n (1) and eq^n (2), we get

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

Sets Ex 1.6 Q2(v)

v. $A=\{1,2,4,5\}, B=\{2,3,5,6\}, C$ [illegible]

$B\cap C=\{5,6\}$

$A-(B\cap C)=\{1,2,4\}\ldots\ldots\ldots(1)$

$(A-B)=\{1,4\}$

$(A-C)=\{1,2\}$

$(A-B)\cup(A-C)=\{1,2,4\}\ldots\ldots\ldots\ldots(2)$

From eq^n (1) and eq^n(2), we get

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

Sets Ex 1.6 Q2(vi)

vi. $A=\{1,2,4,5\}, B=\{2,3,5,6\}, C=\{4,5,6,7\}$

$B\Delta C=(B-C)\cup(C-B)=\{2,3\}\cup\{4,7\}=\{2,3,4,7\}$

$A\cap(B\Delta C)=\{2,4\}\ldots\ldots\ldots(1)$

$(A\cap B)=\{2,5\}$

$(A\cap C)=\{4,5\}$

$(A\cap B)\Delta(A\cap C)=[(A\cap B)-(A\cap C)]\cup[(A\cap C)-(A\cap B)]$

$(A\cap B)\Delta(A\cap C)=\{2\}\cup\{4\}=\{2,4\}\ldots\ldots\ldots\ldots(2)$

From eq^n (1) and eq^n(2), we get

$A\cap(B\Delta C)=(A\cap B)\Delta(A\cap C)$

Sets Ex 1.6 Q3(i)

$U=\{2,3,5,7,9\}$ is the universal set

$A=\{3,7\}$, $B=\{2,5,7,9\}$

$A\cup B=\{x:x\in A \text{ or } x\in B\}$

$=\{2,3,5,7,9\}$

LHS $=(A\cup B)'$

$=\{2,3,5,7,9\}'$

$=U-A\cup B$

$=\phi$

RHS $=A'\cap B'$

$A'=\{x\in U: x\notin A\}$

$=\{2,5,9\}$

$B'=\{x\in U: x\notin B\}$

$=\{3\}$

$\therefore\ A'\cap B'=\{2,5,9\}\cap\{3\}$

$=\phi$ [$\because$ the two sets are disjoint]

$\therefore$ LHS = RHS Proved

Sets Ex 1.6 Q3(ii)

LHS $=(A\cap B)'$

Now,

$A\cap B=\{x|x\in A \text{ and } x\in B\}$

$=\{7\}$

$\therefore (A\cap B)'=\{7\}'$

$=\{x\in U: x\notin 7\}$

$=\{2,3,5,9\}$

RHS $=A'\cup B'$

Now, $A'=\{2,5,9\}$ [form (i)]

and $B'=\{3\}$ [from (i)]

$\therefore\ A'\cup B'=\{2,3,5,9\}$

Hence, LHS = RHS Prove

Sets Ex 1.6 Q4(i)

i. Let $x \in B$. Then

$\Rightarrow x \in B \cup A$

$\Rightarrow x \in A \cup B$

$\therefore B \subset (A \cup B)$

Sets Ex 1.6 Q4(ii)

ii. Let $x \in A \cap B$. Then

$\Rightarrow x \in A$ and $x \in B$

$\Rightarrow x \in B$

$\therefore (A \cap B) \subset B$

Sets Ex 1.6 Q4(iii)

iii. Let $x \in A \subset B$. Then

$\Rightarrow x \in B$

Let and $x \in A \cap B$

$\Leftrightarrow x \in A$ and $x \in B$

$\Leftrightarrow x \in A$ and $x \in A$ $\quad (\because A \subset B)$

$\therefore (A \cap B) = A$

Sets Ex 1.6 Q5

(i)

In order to show that the following four statements are equivalent, we need to show that $(1) \Rightarrow (2)$, $(2) \Rightarrow (3)$, $(3) \Rightarrow (4)$ and $(4) \Rightarrow (1)$

We first show that $(1) \Rightarrow (2)$

We assume that $A \subset B$, and use this to show that $A - B = \phi$

Now $A - B = \{x \in A : x \notin B\}$. As $A \subset B$,

$\therefore$ Each element of A is an element of B,

$\therefore$ $A - B = \phi$

Hence, we have proved that $(1) \Rightarrow (2)$.

(ii)

We new show that $(2) \Rightarrow (3)$

So assume that $A - B = \phi$

To show: $A \cup B = B$

$\because$ $A - B = \phi$

$\therefore$ Every element of A is an element of B

$[\because A - B = \phi$ only when ther is some element in A which is not in $B]$

So $A \subset B$ and therefore $A \cup B = B$

So $(2) \Rightarrow (3)$ is true.

(iii)

We new show that $(3) \Rightarrow (4)$

Assume that $A \cup B = B$

To show: $A \cap B = A$

$\because$ $A \cup B = B$

$\therefore$ $A \subset B$ and so $A \cap B = A$

So $(3) \Rightarrow (4)$ is true.

(iv)

Finally we show that $(4) \Rightarrow (1)$, which will prove the equivalence of the four statements.

So, assume that $A \cap B = A$

To show: $A \subset B$

$A \cap B = A$ therefore $A \subset B$ and so $(4) \Rightarrow (1)$ is true

$\because A \cap B = A$, therefore $A \subset B$, and so $(4) \Rightarrow (1)$ is true.

Hence, $(1) \Leftrightarrow (2) \Leftrightarrow (3) \Leftrightarrow (4)$.

Sets Ex 1.6 Q6(i)

Let $A = \{1,2,3\}$, $B = \{2,4,6\}$ and $C = \{2,5,7\}$

Then,

$A \cap B = \{2\}$

and $A \cap C = \{2\}$

Hence, $A \cap B = A \cap C$, but clearly $B \neq C$.

Sets Ex 1.6 Q6(ii)

Given $A \subset B$

To show: $C - B \subset C - A$

Let $x \in C - B$

$\Rightarrow x \in C$ and $x \notin B$ [by definition of $C - B$]

$\Rightarrow x \in C$ and $x \notin A$ [$\because A \subset B$]

This can be seen by the venn diagram above

$\Rightarrow x \in C - A$ [by definition of $C - A$]

Thus $x \in C - B \Rightarrow x \in C - A$. This is true for all $x \in C - B$

$\therefore C - B \subset C - A$

Sets Ex 1.6 Q7

(i)

$A \cup (A \cap B) = (A \cup A) \cap (A \cup B)$ [$\because$ union $\cup$ is distributive over intersection $\cap$]

$= A \cap (A \cup B)$ [$\because A \cup A = A$]

$= A$ [$\because A \subset (A \cup B)$, as union of two sets is bigger than each of the individual sets]

Hence, $A \cup (A \cap B) = A$ Proved.

(ii)

$A \cap (A \cup B) = (A \cap A) \cup (A \cap B)$ [$\because \cap$ distributes over $\cup$]

$= A \cup (A \cap B)$ [$\because A \cap A = A$]

$= A$ [using (i)]

Sets Ex 1.6 Q8

To find sets A, B and C such that $A \cap B \neq \phi$, $A \cap C = \phi$ and $B \cap C = \phi$ and $A \cap B \cap C = \phi$

Take $A = \{1,2,3\}$

$B = \{2,4,6\}$

and $C = \{3,4,7\}$

Then,

$A \cap B = \{2\}$

$\therefore A \cap B \neq \phi$

$A \cap C = \{3\}$

$\therefore A \cap C \neq \phi$

$B \cap C = \{4\}$

$\therefore B \cap C \neq \phi$

However A, B and C have no elements in common,

$\therefore A \cap B \cap C = \phi$

Sets Ex 1.6 Q9

Given $A \cap B = \phi$, i.e., A and B are disjoint sets this can represented by venn diagram as follows

To show: $A \subseteq B'$

This is clear from the venn diagram itself

$\because A$ is lying in the complement of B, but we give a proof of it.

So let $x \in A$

$\because A \cap B = \phi$,

$\therefore x \notin B$

and so $x \in B'$

Thus $x \in A \Rightarrow$

Hence, $A \subseteq B'$

Sets Ex 1.6 Q10

We need to show that $(A - B) \cap (A \cap B) = \phi$, $(A \cap B) \cap (B - A) = \phi$ and $(A - B) \cap (B - A) = \phi$

The 3 sets $A - B$, $A \cap B$ and $B - A$ may be represented by a venn diagram as follows

It is clear from the diagram that the 3 sets are pairwise disjoint, but we shall give a proff of it.

We first show that $(A - B) \cap (A \cap B) = \phi$

Let $x \in (A - B)$

$\Rightarrow \quad x \in A$ and $x \notin B$ $\quad$ [by definition of $A - B$]

$\Rightarrow \quad x \notin A \cap B$. This is true for all $x \in (A - B)$

Hence $(A - B) \cap (A \cap B) = \phi$

On a similar lines, it can be seen that $(A \cap B) \cap (B - A) = \phi$

Finally, we show that $(A - B) \cap (B - A) = \phi$

We have,

$$A - B = \{x \in A : x \notin B\}$$

and $\quad B - A = \{x \in B : x \notin A\}$

Hence, $(A - B) \cap (B - A) = \phi$.

Sets Ex 1.6 Q11

We need to show $(A \cup B) \cap (A \cap B') = A$

Now,

$(A \cup B) \cap (A \cap B') = ((A \cup B) \cap A) \cap B'$ $\quad$ [Using associative property]

$= ((A \cap A) \cup (B \cap A)) \cap B'$ $\quad$ [$\because A \cap A = A$ and $B \cap A = A \cap B$, by commutative law]

$= A \cap B'$ $\quad$ [$\because A \cup (A \cap B) = A$]

$= A$

Sets Ex 1.6 Q12(i)

We have $A' \cup B = \cup$, the universal set

To show: $A \subset B$

Let, $x \in A$

$\Rightarrow \quad x \notin A'$ $\quad$ [$\because A \cap A' = \phi$]

$\because \quad x \in A$ and $A \subset \cup$

$\Rightarrow \quad x \in \cup$

$\Rightarrow \quad x \in (A' \cup B)$ $\quad$ [$\because \cup = A' \cup B$]

$\Rightarrow \quad x \in A'$ or $x \in B$

But, $x \notin A'$,

$\therefore \quad x \in B$

Thus, $x \in A \Rightarrow x \in B$

This is true for all $x \in A$

$\therefore \quad A \subset B$

Sets Ex 1.6 Q12(ii)

We have $B' \subset A'$

To show: $A \subset B$

Let, $x \in A$

$\Rightarrow \quad x \notin A'$ $\quad$ [$\because A \cap A' = \phi$]

$\Rightarrow \quad x \notin B'$ $\quad$ [$\because B' \subset A'$]

$\Rightarrow \quad x \in B$ $\quad$ [$\because B \cap B' = \phi$]

Thus, $x \in A \Rightarrow x \in B$

This is true for all $x \in A$

$\therefore \quad A \subset B$

Sets Ex 1.6 Q13

This is a false statement

Let, $A = \{1\}$ and $B = \{2\}$

Then,

$P(A) = \{\phi, \{1\}\}$

and $P(B) = \{\phi, \{2\}\}$

$\therefore$ $P(A) \cup P(B) = \{\phi, \{1\}, \{2\}\}$

Now,

$A \cup B = \{1, 2\}$

and $P(A \cup B) = \{\phi, \{1\}, \{2\}, \{1, 2\}\}$

Hence, $P(A) \cup P(B) \neq P(A \cup B)$

Sets Ex 1.6 Q14(i)

i. We know that $(A \cap B) \subset A$ and $(A - B) \subset A$

$\Rightarrow (A \cap B) \cap (A - B) \subset A$..........(1)

Let and $x \in (A \cap B) \cap (A - B)$

$\Rightarrow x \in (A \cap B)$ and $x \in (A - B)$

$\Rightarrow x \in A$ and $x \in B$ and $x \in A$ and $x \notin B$

$\Rightarrow x \in A$ and $x \in A$ $[\because x \in B$ and $x \notin B$ are not possible simultaneously$]$

$\Rightarrow x \in A$

$\therefore (A \cap B) \cap (A - B) \subset A$........(2)

From (1) and (2), we get

$A = (A \cap B) \cap (A - B)$

Sets Ex 1.6 Q14(ii)

ii. Let $x \in A \cup (B - A)$

$\Rightarrow x \in A$ or $x \in (B - A)$

$\Rightarrow x \in A$ or $x \in B$ and $x \notin A$

$\Rightarrow x \in A$ or $x \in B$

$\Rightarrow x \in (A \cup B)$

$\therefore A \cup (B - A) \subset (A \cup B)$..........(1)

Let and $x \in (A \cup B)$

$\Rightarrow x \in A$ or $x \in B$

$\Rightarrow x \in A$ or $x \in B$ and $x \notin A$

$\Rightarrow x \in A$ or $x \in (B - A)$

$\Rightarrow x \in A \cup (B - A)$

$\therefore (A \cup B) \subset A \cup (B - A)$........(2)

From (1) and (2), we get

$A \cup (B - A) = A \cup B$

Sets Ex 1.6 Q15

Since each X_r has 5 elements and each element of S belongs to exactly 10 of X_r's.

$\therefore S = \bigcup_{r=1}^{20} X_r \Rightarrow \frac{1}{10}\sum_{r=1}^{20} n(X_r) = \frac{1}{10}(5 \times 20) = 10$.......(i)

Since each Y_r has 2 elements and each element of S belongs to exactly 4 of X_r's.

$\therefore S = \bigcup_{r=1}^{n} X_r \Rightarrow \frac{1}{4}\sum_{r=1}^{n} n(Y_r) = \frac{1}{4}(2n) = \frac{n}{2}$....(ii)

From (i) and (ii), we get

$10 = \frac{n}{2} \Rightarrow n = 20$

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.7

Sets Ex 1.7 Q1

To show $A' - B' = B - A$

We show that $A' - B' \subseteq B - A$ and vice versa

Let, $x \in A' - B'$

$\Rightarrow \quad x \in A'$ and $x \notin B'$

$\Rightarrow \quad x \notin A$ and $x \in B$ $\quad [\because A \cap A' = \phi$ and $B \cap B' = \phi]$

$\Rightarrow \quad x \in B$ and $x \notin A$

$\Rightarrow \quad x \in B - A$

This is true for all $x \in A' - B$
Hence $A' - B' \subseteq B - A$

Conversely,

Let, $x \in B - A$
$\Rightarrow \quad x \in B$ and $x \notin A$
$\Rightarrow \quad x \notin B'$ and $x \in A'$ $\quad [\because B \cap B' = \phi$ and $A \cap A' = \phi]$
$\Rightarrow \quad x \in A'$ and $x \notin B'$
$\Rightarrow \quad x \in A' - B'$
This is true for all $x \in B - A$
Hence $B - A \subseteq A' - B'$

$\therefore A' - B' = B - A$ Proved.

Sets Ex 1.7 Q2(i)

LHS $= A \cap (A' \cup B)$
$= (A \cap A') \cup (A \cap B)$ $\quad [\because \cap$ distributes over (i)$]$
$= \phi \cup (A \cap B)$ $\quad [\because A \cap A' = \phi]$
$= A \cap B$ $\quad [\because \phi \cup x = x$ for any set $x]$
$=$ RHS

$\therefore$ LHS = RHS Proved.

Sets Ex 1.7 Q2(ii)

For any sets A and B we have by De-morgan's laws
$(A \cup B)' = A' \cap B'$, $(A \cap B)' = A' \cup B'$

Also,
LHS $= A - (A - B)$
$= A \cap (A - B)'$
$= A \cap (A \cap B')'$
$= A \cap (A' \cup (B')')$ $\quad$ [By De-morgan's law]
$= A \cap (A' \cup B)$ $\quad [\because (B')' = B]$
$= (A \cap A') \cup (A \cap B)$
$= \phi \cup (A \cap B)$ $\quad [\because A \cap A' = \phi]$
$= A \cap B$ $\quad [\because \phi \cup x = x$, for any set $x]$
$=$ RHS

$\therefore$ LHS = RHS Proved.

Sets Ex 1.7 Q2(iii)

LHS $= A \cap (A \cup B')$
$= A \cap (A' \cap B')$ $\quad$ [By De-morgan's law]
$= (A \cap A') \cap B'$ $\quad$ [By associative law]
$= \phi \cap B'$ $\quad [\because A \cap A' = \phi]$
$= \phi$
$=$ RHS

$\therefore$ LHS = RHS Proved.

Sets Ex 1.7 Q2(iv)

RHS $= A \Delta (A \cap B)$
$= (A - (A \cap B)) \cup (A \cap B - A)$ $\quad [\because E \Delta F = (E - F) \cup (F - E)]$
$= (A \cap (A \cap B)') \cup (A \cap B \cap A')$ $\quad [\because E - F = E \cap F']$
$= (A \cap (A' \cup B')) \cup (A \cap A' \cap B)$ $\quad$ [By De-morgan's law & associative law]
$= (A \cap A') \cup (A \cap B') \cup (\phi \cap B)$ $\quad [\because \cap$ distributes over $\cup$ and $A \cap A' = \phi]$
$= \phi \cup (A \cap B') \cup \phi$ $\quad [\because \phi \cap B = \phi]$
$= A \cap B'$ $\quad [\because \phi \cup x = x$ for any set $x]$
$= A - B$ $\quad [\because A \cap B' = A - B]$
$=$ LHS

$\therefore$ LHS = RHS Proved.

Sets Ex 1.7 Q3

We have, ACB

To show: $C - B \subset C - A$

Let, $x \in C - B$

$\Rightarrow \quad x \in C$ and $x \notin B$

$\Rightarrow \quad x \in C$ and $x \notin A \qquad [\because A \subset B]$

$\Rightarrow \quad x \in C - A$

Thus, $x \in C - B \Rightarrow x \in C - A$

This is true for all $x \in C - B$

$\therefore \; C - B \subset C - A$

Sets Ex 1.7 Q4(i)

i. $(A \cup B) - B = (A - B) \cup (B - B)$

$= (A - B) \cup \phi$

$= A - B$

Sets Ex 1.7 Q4(ii)

ii. $A - (A \cap B) = (A - A) \cap (A - B)$

$= \phi \cap (A - B)$

$= A - B$

Sets Ex 1.7 Q4(iii)

iii.Let $x \in A - (A - B) \Leftrightarrow x \in A$ and $x \notin (A - B)$

$\Leftrightarrow x \in A$ and $x \in (A \cap B)$

$\Leftrightarrow x \in A \cap (A \cap B)$

$\Leftrightarrow x \in (A \cap B)$

$\therefore A - (A - B) = (A \cap B)$

Sets Ex 1.7 Q4(iv)

iv.Let $x \in A \cup (B - A) \Rightarrow x \in A$ or $x \in (B - A)$

$\Rightarrow x \in A$ or $x \in B$ and $x \notin A$

$\Rightarrow x \in B$

$\Rightarrow x \in (A \cup B) \quad [\because B \subset (A \cup B)]$

This is true for all $x \in A \cup (B - A)$

$\therefore A \cup (B - A) \subset (A \cup B)$.........(1)

Conversely,

Let, $x \in (A \cup B)$

$\Rightarrow x \in A$ or $x \in B$

$\Rightarrow x \in A$ or $x \in (B - A) \quad [\because B \subset (B - A)]$

$\Rightarrow x \in A \cup (B - A)$

$\therefore (A \cup B) \subset A \cup (B - A)$..........(2)

From (1) and (2), we get

$A \cup (B - A) = (A \cup B)$

Sets Ex 1.7 Q4(v)

v.Let $x \in A$.

Then either $x \in (A - B)$ or $x \in (A \cap B)$

$\Rightarrow x \in (A - B) \cup (A \cap B)$

$\therefore A \subset (A - B) \cup (A \cap B)$..........(1)

Conversely,

Let $x \in (A - B) \cup (A \cap B)$

$\Rightarrow x \in (A - B)$ or $x \in (A \cap B)$

$\Rightarrow x \in A$ and $x \notin B$ or $x \in A$ and $x \in B$

$\Rightarrow x \in A$

$\therefore (A - B) \cup (A \cap B) \subset A$..............(2)

$\therefore$ From (1) and (2), we get

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

RD Sharma Solutions Class 11 Maths Chapter 1 Ex 1.8

Sets Ex 1.8 Q1

$n(A \cup B) = 50,\ n(A) = 28,\ n(B) = 32,$ where $n(x)$ doesnotes the cardinal number of the set x.

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

$\Rightarrow \quad 50 = 28 + 32 - n(A \cap B)$

$\Rightarrow \quad 50 = 60 - n(A \cap B)$

$\Rightarrow \quad n(A \cap B) = 60 - 50$

$= 10$

$\therefore \ n(A \cap B) = 10$

Sets Ex 1.8 Q2

We have,

$n(P) = 40,\ n(P \cup Q) = 60,\ n(P \cap Q) = 10,$ to find $n(Q)$.

We know $n(P \cup Q) = n(P) + n(Q) - n(P \cap Q)$

$\Rightarrow \quad 60 = 40 + n(Q) - 10$

$\Rightarrow \quad 60 = 30 + n(Q)$

$\Rightarrow \quad n(Q) = 60 - 30$

$= 30$

Hence, Q has 30 elements.

Sets Ex 1.8 Q3

Let $n(P)$ denote the number of teachers who teach Physics and $n(Q)$ denote the number of teachers who teach Mathematics.

We have,

$n(P \text{ or } M) = 20$

i.e $n(P \cup M) = 20$

$n(M) = 12$

and $\quad n(P \cap M) = 4$

To find: $n(P)$

We know $n(P \cup M) = n(P) + n(M) - n(P \cap M)$

$\Rightarrow \quad 20 = n(P) + 12 - 4$

$\Rightarrow \quad 20 = n(P) + 8$

$\Rightarrow \quad n(P) = 20 - 8$

$= 12$

$\therefore$ There are 12 Physics teachers.

Sets Ex 1.8 Q4

Let,

$n(P)$ denote the total number of people

$n(C)$ denote the number of people who like coffee and

$n(T)$ denote the number of people who like tea.

Then, $n(P) = 70$

$n(C) = 37$

$n(T) = 52$

We are given that each person likes at least one of the two drinks, i.e., $P = C \cup T$

To find: $n(C \cap T)$

We know $n(P) = n(C) + n(T) - n(C \cap T)$

$\Rightarrow \quad 70 = 37 + 52 - n(C \cap T)$

$\Rightarrow \quad 70 = 89 - n(C \cap T)$

$\Rightarrow \quad n(C \cap T) = 89 - 70$

$= 19$

Hence, 19 people like both coffee and tea.

Sets Ex 1.8 Q5(i)

$n(A) = 20,\ n(A \cup B) = 42$ and $n(A \cap B) = 4,$ to find: $n(B)$

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

$\Rightarrow \quad 42 = 20 + n(B) - 4$

$\Rightarrow \quad 42 = 16 + n(B)$

$\Rightarrow \quad n(B) = 42 - 16$
$= 26$

$\therefore \; n(B) = 26$

Sets Ex 1.8 Q5(ii)

To find: $n(A - B)$

We know that if A and B are disjoint sets, then

$A \cap B = \phi$

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

$\Rightarrow \quad n(A \cup B) = n(A) + n(B) \qquad [\because n(\phi) = 0]$

Now,

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

i.e A is the disjoint union of $A - B$ and $A \cap B$

$\therefore \quad n(A) = n(A - B) \cup (A \cap B)$
$= n(A - B) + n(A \cap B) \qquad [\because A - B \text{ and } A \cap B \text{ are disjoint}]$

$\Rightarrow \quad 20 = n(A - B) + 4$

$\Rightarrow \quad n(A - B) = 20 - 4$
$= 16$

$\therefore \; n(A - B) = 16$

Sets Ex 1.8 Q5(iii)

To find: $B - A$

On a similar lines we have B is the disjoint union of $B - A$ and $A \cap B$

i.e $B = (B - A) \cup (A \cap B)$

$\therefore \quad n(B) = n(B - A) + n(A \cap B)$

$\Rightarrow \quad 26 = n(B - A) + 4 \qquad$ [using (i)]

$\Rightarrow \quad n(B - A) = 26 - 4$
$= 22$

$\therefore \; n(B - A) = 22$

Sets Ex 1.8 Q6

Let $n(P)$ denote the total percentage of Indians $n(O)$ denotes the percentage of Indians who like oranges, and $n(B)$ denotes the percentage of Indians who like bananas.

Then, $n(P) = 100,\; n(O) = 76$ and $n(B) = 62$

To find: $n(O \cap B)$

Now,

$n(P) = n(O) + n(B) - n(O \cap B)$

$\Rightarrow \quad 100 = 76 + 62 - n(O \cap B)$

$\Rightarrow \quad 100 = 138 - n(O \cap B)$

$\Rightarrow \quad n(O \cap B) = 138 - 100$
$= 38$

$\therefore$ 38% of Indians like both oranges and bananas.

Sets Ex 1.8 Q7

(i)

Let,

$n(P)$ denote the total number of persons,

$n(H)$ denote the number of persons who speak Hindi and

$n(E)$ denote the number of persons who speak English.

Then,

$n(P) = 950,\; n(H) = 750,\; n(E) = 460$

To find: $n(H \cap E)$

$n(P) = n(H) + n(E) - n(H \cap E)$

$\Rightarrow \quad 950 = 750 + 460 - n(H \cap E)$

$\Rightarrow \quad 950 = 2110 - n(H \cap E)$

$\Rightarrow \quad n(H \cap E) = 2110 - 950$
$= 260$

Hence, 260 persons can speak both Hindi and English.

(ii)
Clearly H is the disjoint union of $H - E$ & $H \cap$
i.e $H = (H - E) \cup (H \cap E)$

$\therefore \quad n(H) = n(H - E) + n(H \cap E)$ $\left[\begin{array}{l}\because \text{if } A \,\&\, B \text{ are disjoint then} \\ n(A \cup B) = n(A) + n(B)\end{array}\right]$

$\Rightarrow \quad 750 = n(H - E) + 260$

$\Rightarrow \quad n(H - E) = 750 - 260$

$= 490$

Hence, 490 persons can speak Hindi only.

(iii)
On a similar lines we have

$E = (E - H) \cup (H \cap E)$

i.e E is the disjoint union of $E - H$ & $H \cap E$

$\therefore \quad n(E) = n(E - H) + n(H \cap E)$

$\Rightarrow \quad 460 = n(E - H) + 260$

$\Rightarrow \quad n(E - H) = 460 - 260$

$= 200$

Hence, 200 persons can speak English only.

Sets Ex 1.8 Q8

(i)
Let,
$n(P)$ denote the total number of persons,
$n(T)$ denote number of persons who drink tea and
$n(C)$ denote number of persons who drink coffee.

Then, $n(P) = 50$, $n(T - C) = 14$, $n(T) = 30$
To find: $n(T \cap C)$

Clearly T is the disjoint union of $T - C$ and $T \cap C$

$\therefore \quad T = (T - C) \cup (T \cap C)$

$\therefore \quad n(T) = n(T - C) + n(T \cap C)$

$\Rightarrow \quad 30 = 14 + n(T \cap C)$

$\Rightarrow \quad n(T \cap C) = 30 - 14$

$= 16$

Hence, 16 persons drink tea and coffee both.

(ii)
To find: $C - T$
We know $n(P) = n(C) + n(T) - n(T \cap C)$

$\Rightarrow \quad 50 = n(C) + 30 - 16$

$\Rightarrow \quad 50 = n(C) + 14$

$\Rightarrow \quad n(C) = 50 - 14$

$= 36$

New C is the disjoint union of $C - T$ and $T \cap C$

$\therefore \quad C = (C - T) \cup (C \cap T)$

$\Rightarrow \quad n(C) = n(C - T) + n(C \cap T)$

$\Rightarrow \quad 36 = n(C - T) + 16$ $[\because n(T \cap C) = n(C \cap T) = 16]$

$\Rightarrow \quad n(C - T) = 36 - 16$

$= 20$

Hence, 20 persons drink coffee but not tea.

Sets Ex 1.8 Q9

(i)
Let $n(P)$ denote total number of people $n(H)$ denote number of people who read newspaper H $n(T)$ denote number of people who read newspaper T and $n(I)$ denote number of people who read newspaper I

Then, $n(P) = 60,\ n(H) = 25,\ n(T) = 26,\ n(I) = 26$

$n(H \cap I) = 9,\ n(H \cap T) = 11,\ n(T \cap I) = 8,\ n(H \cap T \cap I) = 3$

We need to find the number of people who read at least one of the newspaper, i.e., $n(H \text{ or } T \text{ or } I)$, i.e., $n(H \cup T \cup I)$ we know that if A, B, C are 3 sets, then,

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

$\therefore\ n(H \cup T \cup I) = n(H) + n(T) + n(I) - n(H \cap T) - n(T \cap I) - n(H \cap I) + n(H \cap T \cap I)$

$= 25 + 26 + 26 - 9 - 11 - 8 + 3$

$= 25 + 52 - 28 + 3$

$= 25 + 52 - 25$

$= 52$

Hence, 52 people read at least one of the newspaper.

(ii)

The venn diagram representing people reading newspapers H, T and I is shown above.

The shaded region shows the number of people who read newspaper H only, newspaper T only and newspaer I only respectively.

The number of people who read newspaper H only equals

$25 - (8 + 3 + 6)$

$= 25 - 17$

$= 8$

The number of people who read newspaper T only

$= 26 - (8 + 3 + 5)$

$= 26 - 16$

$= 10$

And, the number of people who read newspaper I only

$= 26 - (6 + 3 + 5)$

$= 26 - 14$

$= 12$

Hence, the number of people, who read exactly one newspaper $= 8 + 10 + 12 = 30$.

Sets Ex 1.8 Q10

Let,

$n(P)$ denote total number of members,

$n(B)$ denote number of members in the basket ball team

$n(H)$ denote number of members in the hockey team and

$n(F)$ denote number of members in the football team.

Then, $n(B) = 21,\ n(H) = 26$, and $n(F) = 29$

Also, $n(H \cap B) = 14,\ n(H \cap F) = 15,\ n(F \cap B) = 12,\ n(H \cap B \cap F) = 8$

Now,

$P = B \cup H \cup F$

$\therefore\ n(P) = n(B \cup H \cup F)$

$= n(B) + n(H) + n(F) - n(B \cap H) - n(H \cap F) - n(B \cap F) + n(B \cap H \cap F)$

$\Rightarrow\ n(P) = 21 + 26 + 29 - 14 - 15 - 12 + 8$

$= 76 - 41 + 8$

$= 43$

Hence, there are 43 members in all.

Sets Ex 1.8 Q11

Let,

$n(P)$ denote the total number of people,

$n(H)$ the number of people who speak Hindi and

$n(B)$ the number of people who speak Bengali.

Then, $n(P) = 1000,\ n(H) = 750,\ n(B) = 400$

We have $P = (H \cup B)$

$\therefore\ n(P) = n(H \cup B)$

$= n(H) + n(B) - n(H \cap B)$

$\Rightarrow\ 1000 = 750 + 400 - n(H \cap B)$

$\Rightarrow \quad 1000 = 1150 - n(H \cap B)$

$\Rightarrow \quad n(H \cap B) = 1150 - 1000$

$= 150$

Hence, 150 people can speak both Hindi and Bengali now $H = (H - B) \cup (H \cap B)$, the union being disjoint

$\therefore \quad n(H) = n(H - B) + n(H \cap B)$

$\Rightarrow \quad 750 = n(H - B) + 150$

$\Rightarrow \quad n(H - B) = 750 - 150$

$= 600$

Hence, 600 people can speak Hindi only

On a similar lines we have $B = (B - H) \cup (H \cap B)$

$\Rightarrow \quad n(B) = n(B - H) + n(H \cap B)$

$\Rightarrow \quad 400 = n(B - H) + 150$

$\Rightarrow \quad n(B - H) = 400 - 150$

$= 250$

Hence, 250 people can speak Bengali only.

Sets Ex 1.8 Q12

Let,

$n(P)$ denote the total number of television viewers,

$n(F)$ be the number of people who watch football,

$n(H)$ be the number of people who watch hockey and

$n(B)$ be the number of people who watch basket ball.

Then, $n(P) = 500$, $n(F) = 285$, $n(H) = 195$, $n(B) = 115$, $n(F \cap B) = 45$, $n(F \cap H) = 70$,
$n(H \cap B) = 50$ and $n(F \cup H \cup B) = 50$

Now,

$n((F \cup H \cup B')) = n(P) - n(F \cup H \cup B)$

$\Rightarrow \quad 50 = 500 - (n(F) + n(H) + n(B) - n(F \cap H) - n(H \cap B) - n(F \cap B) + n(F \cap H \cap B))$

$\Rightarrow \quad 50 = 500 - (285 + 195 + 115 - 70 - 50 - 45 + n(F \cap H \cap B))$

$\Rightarrow \quad 50 = 500 - 430 - n(F \cap H \cap B)$

$\Rightarrow \quad 50 = 70 - n(F \cap H \cap B)$

$\Rightarrow \quad n(F \cap H \cap B) = 70 - 50$

$= 20$

Hence, 20 people watch all the 3 games

Number of people who watch only football

$= 285 - (50 + 20 + 25)$

$= 285 - 95$

$= 190$

Number of people who watch only hockey

$= 195 - (50 + 20 + 30)$

$= 195 - 100$

$= 95$

And, number of people who watch only basket ball

$= 115 - (25 + 20 + 30)$

$= 115 - 75$

$= 40$

Number of people who watch exactly one of the three games

= number of people who watch either football only or hockey only or basket ball only

$= 190 + 95 + 40 \qquad [\because$ they are pairwise disjoint$]$

$= 325$

Hence, 325 people watch exactly one of the three games.

Sets Ex 1.8 Q13

(i)

Let $n(P)$ denote total number of persons

$n(A)$ denote number of people who read magazine A

$n(B)$ denote number of people who read magazine B

and $n(C)$ denote number of people who read magazine C

and $n(C)$ denote number of people who read magazine C

Then, $n(P) = 100,\ n(A) = 28,\ n(B) = 30,\ n(C) = 42,\ n(A \cap B) = 8,$
$n(A \cap C) = 10, n(B \cap C) = 5,\ n(A \cap B \cap C) = 3$

Now,

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$
$$= 28 + 30 + 42 - 8 - 10 - 5 + 3$$
$$= 100 - 23 + 3$$
$$= 100 - 20$$
$$= 80$$

$\therefore$ Number of people who read none of the three magazines

$$= n(A \cup B \cup C)'$$
$$= n(P) - n(A \cup B \cup C)$$
$$= 100 - 80$$
$$= 20$$

Hence, 20 people read none of the three magazines.

(ii)

$$n(C\ only) = 42 - (7 + 3 + 2)$$
$$= 42 - 12$$
$$= 30$$

Sets Ex 1.8 Q14

(i)

Let $n(P)$ denote total number of students

$n(E)$ denote number of students studying English language

$n(H)$ denote number of students studying Hindi language and

$n(S)$ denote number of students studying Sanskrit language

Then, $n(P) = 100,\ n(E - H) = 23,\ n(E \cap S) = 8,\ n(E) = 26,\ n(S) = 48,$
$n(S \cap H) = 8,\ n((E \cup H \cup S)') = 24$

Number of students studying English only = 18

We have,

$$n((E \cup H \cup S)') = 24$$
$$\Rightarrow \quad n(P) - n(E \cup H \cup S) = 24$$
$$\Rightarrow \quad 100 - 24 = n(E \cup H \cup S)$$
$$\Rightarrow \quad n(E \cup H \cup S) = 76$$

We have $n(E \cup H \cup S) = n(E) + n(H) + n(S) - n(E \cap H) - n(H \cap S) - n(E \cap S)$
$+ n(E \cap H \cap S)$

$$\Rightarrow \quad 76 = 26 + n(H) + 48 - 3 - 8 - 8 + 3$$
$$\Rightarrow \quad 76 = 26 + n(H) + 48 - 16$$
$$\Rightarrow \quad 76 = 26 + 32 + n(H)$$
$$\Rightarrow \quad n(H) = 76 - 58$$
$$= 18$$

$\therefore$ 18 students were studying Hindi.

(ii)

From (i) we have $n(E \cap H) = 3$

$\therefore$ 3 students were studying both English and Hindi.

Sets Ex 1.8 Q15

Let $n(P_1)$ be the number of persons liking product P_1

$n(P_2)$ be the number of persons liking product P_2

and $n(P_3)$ be the number of persons liking product P_3

Then, $n(P_1) = 21,\ n(P_2) = 26,\ n(P_3) = 29,\ n(P_1 \cap P_2) = 14,$
$n(P_1 \cap P_3) = 12,\ n(P_2 \cap P_3) = 14,\ n(P_1 \cap P_2 \cap P_3) = 8$

$= 29 - 18$

$= 11$

Hence, 11 persons liked product P_3 only.