

chapter-5

Sets

Exercise 5-A

Q-1 Which of the following collections of objects are sets?

i) All the months in a year.

i) Set Yes, it is a set.

ii) All the rivers flowing in India.

ii) Yes, it is a set.

iii) All the planets in the solar system.

iii) Yes, it is a set.

iv) All the interesting dramas written by Shakespeare.

iv) No, it is not a set.

v) All the short boys of your class.

v) No, it is not a set.

vi) All the letters of English Alphabet which precede K.

vi) Yes, it is a set.

vii) All the pet dogs in Meerut.

vii) Yes, it is a set.

viii.) All the dishonest dealers in Delhi.
viii.) No, it is not a set.

ix.) All the students of your ~~class~~ school with age exceeding 120 years.
Yes, it is a set.

x.) All the girls of Meena's class, who are taller than Meena.
Yes, it is a set.

Ques 2 Rewrite the following statements using set notation :-

(i) p is an element of Set A .

(i) $p \in A$

ii.) q does not belong to set B .

ii.) $q \notin B$

iii.) a and b are members of set C .

iii.) $a, b \in C$

iv.) B and C are equivalent sets.

iv.) $B \leftrightarrow C$

v.) Cardinal number of set E is 15.

v.) $n(E) = 15$

vi.) A is an empty set and B is a non-empty set.

$A = \emptyset$ and $B \neq \emptyset$

vii) 0 is a whole number, but 0 is not a natural number.
 $0 \in W$ but $0 \notin N$

ques-3 Describe the following sets in roster form:-

i) $B = \{x \mid x \in W, x \leq 6\}$

$$B = \{0, 1, 2, 3, 4, 5, 6\}$$

ii) $C = \{x \mid x \text{ is a factors of } 32\}$

$$C = \{1, 2, 4, 8, 16, 32\}$$

iii) $E = \{x \mid x = (2n+1), n \in W, n < 4\}$

$$x = 2n+1, n \in W, n < 4 \Rightarrow n = 0, 1, 2, 3, 4$$

$$n = 0 = 2 \times 0 + 1 = 1$$

$$n = 1 = 2 \times 1 + 1 = 3$$

$$n = 2 = 2 \times 2 + 1 = 5$$

$$n = 3 = 2 \times 3 + 1 = 7$$

$$n = 4 = 2 \times 4 + 1 = 9$$

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

iv) $F = \{x \mid x = n^2, n \in N, 2 \leq n \leq 5\}$

$$x = n^2, n \in N, n = 2, 3, 4, 5$$

$$n = 2, x = 2^2 = 4$$

$$n = 3, x = 3^2 = 9$$

$$n = 4, x = 4^2 = 16$$

$$n = 5, x = 5^2 = 25$$

$$F = \{4, 9, 16, 25\}$$

$$v) G = \left\{ x \mid x = \frac{n}{n+3}, n \in \mathbb{N} \text{ and } n \leq 5 \right\}$$

$$x = \frac{n}{n+3}, n \in \mathbb{N} \text{ and } n \leq 5$$

$$n = 1 = x = \frac{1}{1+3} = \frac{1}{4}$$

$$n = 2 = x = \frac{2}{2+3} = \frac{2}{5}$$

$$n = 3 = x = \frac{3}{3+3} = \frac{3}{6} = \frac{1}{2}$$

$$n = 4 = x = \frac{4}{4+3} = \frac{4}{7}$$

$$n = 5 = x = \frac{5}{5+3} = \frac{5}{8}$$

$$G = \left\{ \frac{1}{4}, \frac{2}{5}, \frac{1}{2}, \frac{4}{7}, \frac{5}{8} \right\}$$

vi) $H = \{ x \mid x \text{ is a two-digit number, the sum of whose digits is } 8 \}$

Two digits number whose sum of digits is 8.

$$= 17, 26, 35, 44, 53, 62, 71, 80$$

$$H = \{17, 26, 35, 44, 53, 62, 71, 80\}$$

vii) $I = \{x \mid x \in \mathbb{N}, x \text{ is divisible both by 4 and 6 and } x \leq 60\}$

Number divisible by both 4 and 6 are = 12, 24, 36, 48, 60

$$\begin{array}{l} 2 \mid 4, 6 \\ 2 \mid 2, 3 \\ 3 \mid 1, 3 \end{array}$$

$$I = \{12, 24, 36, 48, 60\}$$

1, 1

$$LCM = 2 \times 2 \times 3 = 12$$

viii) $J = \{x \mid x = \frac{1}{n}, n \in \mathbb{N} \text{ and } n \leq 5\}$ = 12

$$x = \frac{1}{n}, n \in \mathbb{N} \text{ and } n \leq 5$$

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

$$n = 2 = x = \frac{1}{2}$$

$$n = 3 = x = \frac{1}{3}$$

$$n = 4 = x = \frac{1}{4}$$

$$n = 5 = x = \frac{1}{5}$$

$$J = \left\{ \frac{1}{1}, \frac{1}{2}, \frac{1}{3} \right\}$$

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$$J = \left\{ 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5} \right\}$$

(ix) $L = \{x \mid x \text{ is a letter of the word 'Cantelena'}\}$
 $L = \{c, a, n, e, l, s\}$

Ques 4 Describe the following set in set-builder form:

(i) $A = \{5, 6, 7, 8, 9, 10, 11, 12\}$

(ii) $A = \{x \mid x \in \mathbb{N}, 4 < x < 13\}$

(iii) $B = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

(iv) $B = \{x \mid x \text{ is a factor of } 48\}$

(v) $C = \{11, 13, 17, 19, 23, 29, 31, 37\}$

(vi) $C = \{x \mid x \text{ is a prime number, } 10 < x < 40\}$

(vii) $D = \{21, 23, 25, 27, 29, 31, 33, 35, 37\}$

(viii) $D = \{x \mid x = 2n + 19n \in \mathbb{N}, 1 \leq n \leq 9\}$

(ix) $I = \{9, 16, 25, 36, 49, 64, 81, 100\}$

(x) $I = \{x \mid x = n^2, n \in \mathbb{N}, 3 \leq n \leq 10\}$

(xi) $J = \{-2, 2\}$

(xii) $J = \{x \mid x \in \mathbb{Z}, x^2 = 4\}$

$$K = \{0\}$$

$$K = \{x \mid x + 1 = 1\}$$

$$L = \{\}$$

$$L = \{x \mid x \in \mathbb{N}, x \neq x\}$$

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

$$M = \{x \mid x \text{ is a letter of the english alphabet which precedes } k\}$$

$$P = \left\{ \frac{2}{7}, \frac{3}{8}, \frac{4}{9}, \frac{5}{10}, \frac{6}{11}, \frac{7}{12}, \frac{8}{13}, \frac{9}{14} \right\}$$

$$P = \left\{ x \mid x = \frac{n}{n+5}, n \in \mathbb{N}, 2 \leq n \leq 9 \right\}$$

$$S = \{\text{Atlantic}, \text{Arctic}\}$$

$$S = \{x \mid x \text{ is an ocean whose name begins with } A\}$$

$$T = \{\text{Mars}, \text{Mercury}\}$$

$$T = \{x \mid x \text{ is a planet whose name begins with } M\}$$

Ques-5 Separate finite and infinite sets from the following :-

ii) Set of leaves on a tree

iii) Finite Set

iv) Set of all Counting numbers

v) infinite set

vi) $\{x \mid x \in \mathbb{N}, x > 1000\}$

vii) infinite set

viii) $\{x \mid x \in \mathbb{W}, x < 5000\}$

ix) finite set

x) $\{x \mid x \in \mathbb{Z}, x < 4\}$

xi) infinite set

xii) Set of all triangles in a plane

xiii) infinite set

xiv) Set of all points on the circumference of a circle.

xv) infinite set

xvi) $\{1, 2, 3, 1, 2, 3, 1, 2, 3, \dots\}$

xvii) infinite set

Ex $\{x \in \mathbb{R}, 2 < x < 3\}$.

Finite set

Which of the following are empty sets?

i) $A = \{x \mid x \in \mathbb{N}, x + 5 = 5\}$

ii) Set A is an empty set

iii) $B = \{x \mid x \in \mathbb{N}, 2x + 3 = 6\}$

iv) Set B is an empty set

v) $C = \{x \mid x \in \mathbb{W}, x + 2 < 2\}$

vi) Set C is an empty set

vii) $D = \{x \mid x \in \mathbb{N}, 1 < x \leq 2\}$

viii) $D = \{2\} \neq \emptyset$

ix) $E = \{x \mid x \in \mathbb{N}, x^2 + 4 = 0\}$

x) Set E is an empty set

xi) $F = \{x \mid x \text{ is a prime number}, 90 < x < 96\}$

xii) \Rightarrow Set F is an empty set

xiii) $G = \{x \mid x \text{ is an even prime}\}$

xiv) $G = \{2\} \neq \emptyset$

1. $A = \{2, 4, 6\}$

2. $B = \{4, 6, 8, 10\}$

Find the union, intersection and difference of the following sets

(i) $A = \{2, 4, 6, 8\}$ and $B = \{4, 6, 8, 10\}$

$A = \{2, 4, 6, 8\}$
 $B = \{4, 6, 8, 10\}$

$A \cup B = \{2, 4, 6, 8, 10\}$

(ii) $C = \{2, 4, 6, 8, 10\}$ and $D = \{8\}$

$C = \{2, 4, 6, 8, 10\}$
 $D = \{8\}$

$C \cap D = \{8\}$

(iii) If x is a natural number, $x \in \{2\}$ and $x \in \{2\}$ is a whole number, $x \in \{2\}$

(iv) $\{2\} \cap \{2\}$

$\{2\} \cap \{2\} = \{2\}$

(v) If x is an integer, $x \in \{2\}$ and $\{2\} \cap \{2\}$ is a factor of 2

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

$$H = \{1, 2, 4, 8, 16\}$$

$$n(A) = n(H) = 6 \leftrightarrow H$$

State whether the following statements are true or false :-

1) $\{a, b, c, \{2, 3\}\}$ is not a set

False

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

True

2) $\{x \mid x \in \mathbb{N}, x + 8 = 8\}$ is a singleton set

True

$$\{x \mid x \in \mathbb{N}, x < 0\} = \emptyset$$

True

$$\{x \mid x \in \mathbb{N}, x + 5 = 3\} = \emptyset$$

True

$$\{x \mid x \in \mathbb{N}, 3 < x \leq 4\} = \emptyset$$

False

vii.) If $A = \{x \mid x \text{ is a letter of the word 'MEERUT'}\}$, then $n(A) = 6$

vii.) False

viii.) If $A = \{x \mid x \in \mathbb{N}, 8 < x < 13\}$ and $B = \{x \mid x \in \mathbb{Z}, -3 \leq x < 1\}$, then $n(A) = n(B)$

viii.) True

ix.) If $n(A) = n(B)$, then $A = B$

ix.) False

x.) If B is the set of all constants in english alphabet, then $n(B) = 21$.

x.) True

xi.) $\{x \mid x \text{ is a prime factor of } 24\} = \{2, 3, 4, 6, 8, 12, 24\}$

xi.) False

Exercise 5-B

Write down the following statements, using set notation:

1) Set A is a proper subset of set B.

$$A \subset B$$

2) Set C is a superset of set D.

~~$$C \supset D$$~~
$$C \supseteq D$$

3) Set B contains set A.

$$B \supseteq A$$

4) Neither A is a subset of B, nor B is a subset of A.

$$A \not\subset B \text{ and } B \not\subset A$$

Ques 2 Let $A = \{ \text{all quadrilaterals} \}$, $B = \{ \text{all rectangles} \}$, $C = \{ \text{all squares} \}$ and $D = \{ \text{all rhombuses} \}$ in a plane. State, giving reasons, whether the following statements are true or false :-

(i) $B \subset C \subset A$

(ii) False

because all rectangles are not squares.

ii) C C B C A

ii) True
because all squares are rectangles

iii) C C D C A

iii) True
because all squares are rhombuses

iv) D C C C A

iv) ~~False~~ False
because all rhombuses are not squares

v) $A \supseteq B \supseteq C$

v) True
because all squares are rectangles
and all rectangles are quadrilaterals

vi) A C B C C

vi) False
because all quadrilaterals are not rectangles

Ques 3 Let $A = \{ \text{all triangles} \}$, $B = \{ \text{all isosceles triangles} \}$ and $C = \{ \text{all equilateral triangles} \}$.
Give, giving reasons, whether the following statements are true or false:

1) B C C A

False

all isosceles triangles are not equilateral triangles

2) C C B C A

True

because all equilateral triangles are isosceles triangles and all isosceles triangles are equilateral triangles.

Let $A = \{1, 2, 3\}$. State which of the following statements are true:-

i) $1 \subset A$

ii) False

iii) $\{3\} \in A$

iv) False

v) $1 \in A$

vi) True

vii) $\emptyset \in A$

viii) False

ix) $\emptyset \subset A$

x) True

vi.) $\{1\} \notin A$

vi.) False

Ques 5 which of the following statements are correct?

i.) $a \subset \{a, b, c\}$

i.) False

ii.) $\{a\} \in \{a, b, c\}$

ii.) False

iii.) $\{a\} \subset \{a, b, c\}$

iii.) True

iv.) $\emptyset \in \{a, b, c\}$

iv.) False

v.) $\emptyset \subset \{a, b, c\}$

v.) True

vi.) $\{\emptyset\} \subset \{a, b, c\}$

vi.) False

vii.) $a \in \{a, b\}$

vii.) False

viii.) $\{a\} \subset \{\{a\}, b\}$

viii.) False

ix.) $\{a, b\} \in \{\{a, b\}, c\}$

ix.) True

Ques 6 which of the following ~~are~~ statements are true?

(i) $\emptyset = \{0\}$
(i) False

(ii) $\emptyset = \{\emptyset\}$
(ii) False

(iii) $\emptyset \in \{0\}$
(iii) False

(iv) $\emptyset \in \{\emptyset\}$
(iv) True

(v) $\emptyset \in \{\emptyset, \{0\}\}$
(v) True

(vi) $\{\emptyset\} \subset \{0\}$
(vi) False

Ques 7 which of the following statements are true?

(i) For any two sets A and B, either $A \subset B$ or $B \subset A$.
(i) False

(ii) Every subset of a finite set is infinite.
(ii) True

(iii) Every subset of an infinite set is infinite.
(iii) False

iv) Every set has a proper subset.
iv) False

v) If A has n elements, then $P(A)$ has 2^n subsets.

v) True

Ques 8 Let A be the set of letters in the word, 'seed'. Find

(i) A

(i) $A = \{s, e, d\}$

(ii) $n(A)$

(ii) $n(A) = 3$

(iii) number of subsets of A .

(iii) 8

(iv) number of proper subsets of A .

(iv) $2^n - 1$

$$2^3 - 1$$

$$8 - 1 = 7$$

Ques 9 Find all possible subsets of each of the following sets:-

(i) $A = \{4, 9\}$

(i) $\emptyset, \{4\}, \{9\}, \{4, 9\}$

(ii) $B = \{7, 9\}$

(ii) $\emptyset, \{7\}, \{9\}, \{7, 9\}$

$$C = \{0, 1, 2\}$$

$$P(C) = \{\emptyset, \{0\}, \{1\}, \{2\}, \{0, 1\}, \{1, 2\}, \{0, 2\}, \{0, 1, 2\}\}$$

Ques 1) Find the powerset of each of the following sets :-

$$(i) A = \{0, 5\}$$

$$P(A) = \{\emptyset, \{0\}, \{5\}, \{0, 5\}\}$$

$$(ii) B = \{7, 9\}$$

$$P(B) = \{\emptyset, \{7\}, \{9\}, \{7, 9\}\}$$

$$(iii) C = \{2, 4, 6\}$$

$$P(C) = \{\emptyset, \{2\}, \{4\}, \{6\}, \{2, 4\}, \{4, 6\}, \{2, 6\}, \{2, 4, 6\}\}$$

Ques 1) Let $A = \{1, \{2\}\}$. Find the Powerset of A.

$$P(A) = \{\emptyset, \{1\}, \{\{2\}\}, \{1, \{2\}\}\}$$

Ques 2) Let $X = \{x : x \in \mathbb{N}, x < 50\}$, $A = \{x : x^2 \in X\}$?

$B = \{x : x = n^2, n \in \mathbb{N}\}$ and $C = \{x : x \text{ is a factor of } 36\}$. List the elements of each of the sets A, B and C. Also state whether each of the following statements is true or false.

Following statements is true or false.

$$A = \{1, 2, 3, 4, 5, 6, 7\}$$

$$B = \{1, 4, 9, 16, 25, 36, 49\}$$

$$C = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$$

(i) $A \subset B$

(i) False

(ii) $A = B$

(ii) False

(iii) $A \leftrightarrow B$

(iii) True

(iv) $B \leftrightarrow C$

(iv) False

(v) $n(A) < n(C)$

(v) True

Exercise 5-C

1. The following are the details of the transactions of M/s. ABC & Co. during the year 2019-2020.

Particulars

1. To Balance b/d 10000

2. To Cash 5000

Particulars

1. To Cash 2000

2. To Cash 1000

Particulars

1. To Cash 1500

2. To Cash 800

Particulars

1. To Cash 1200

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

v) $B \cap C$

$$B = \{b, c, e\}$$
$$C = \{a, b, c\}$$

$$B \cap C = \{b, c, e\} \cap \{a, b, c\}$$
$$B \cap C = \{b, c\}$$

vi) $A \cap C$

$$A = \{a, b, c, d\}$$
$$C = \{a, b, c\}$$

$$A \cap C = \{a, b, c, d\} \cap \{a, b, c\}$$
$$A \cap C = \{a, b, c\}$$

Ques: Let $A = \{2, 3, 4, 6\}$, $B = \{5, 7, 8\}$ and $C = \{2, 7, 8, 9\}$. Find:-

i) $A \cup B$

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

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

ii) $B \cup C$

$$B = \{5, 7, 8\}$$
$$C = \{2, 7, 8, 9\}$$

$$B \cup C = \{5, 7, 8\} \cup \{2, 7, 8, 9\}$$

$$B \cup C = \{2, 5, 7, 8, 9\}$$

iii) $A \cup C$

$$A = \{2, 3, 4, 6\}$$

$$C = \{2, 7, 8, 9\}$$

$$A \cup C = \{2, 3, 4, 6\} \cup \{2, 7, 8, 9\}$$

$$A \cup C = \{2, 3, 4, 6, 7, 8, 9\}$$

iv) $A \cap B$

$$A = \{2, 3, 4, 6\}$$

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

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

$$A \cap B = \emptyset$$

v) $A \cap C$

$$A = \{2, 3, 4, 6\}$$

$$C = \{2, 7, 8, 9\}$$

$$A \cap C = \{2, 3, 4, 6\} \cap \{2, 7, 8, 9\}$$

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

vi) $B \cap C$

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

$$C = \{2, 7, 8, 9\}$$

$$B \cap C = \{5, 7, 8\} \cap \{2, 7, 8, 9\}$$

$$B \cap C = \{7, 8\}$$

Ques 3 Let $A = \{1, 4, 7, 8\}$ and $B = \{4, 6, 8, 9\}$. Find

(i) $A - B$

$$\begin{aligned} \text{(i)} \quad A &= \{1, 4, 7, 8\} \\ B &= \{4, 6, 8, 9\} \end{aligned}$$

$$\begin{aligned} A - B &= \{1, 4, 7, 8\} - \{4, 6, 8, 9\} \\ A - B &= \{1, 7\} \end{aligned}$$

(ii) $B - A$

$$\begin{aligned} \text{(ii)} \quad B &= \{4, 6, 8, 9\} \\ A &= \{1, 4, 7, 8\} \end{aligned}$$

$$\begin{aligned} B - A &= \{4, 6, 8, 9\} - \{1, 4, 7, 8\} \\ B - A &= \{6, 9\} \end{aligned}$$

Ques 4 Let $\xi = \{13, 14, 15, 16, 17, 18, 19, 20, 21\}$, $A = \{13, 17, 19\}$ and $B = \{14, 16, 18, 20\}$. Find

(i) A'

$$\text{(i)} \quad A' = \{14, 15, 16, 18, 20, 21\}$$

(ii) B'

$$\text{(ii)} \quad B' = \{13, 15, 17, 19, 21\}$$

Ques 5 Let $\xi = \{x \mid x \in \mathbb{Z}, -4 \leq x \leq 4\}$, $A = \{x \mid x \in \mathbb{W}, x < 4\}$ and $B = \{x \mid x \in \mathbb{N}, 2 < x \leq 4\}$.

$A = \{x \mid x \in \mathbb{W}, x < 4\}$ and $B = \{x \mid x \in \mathbb{N}, 2 < x \leq 4\}$.

Find :-

A'

$$S = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$$

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

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

$$A' = \{-3, -2, -1, 4\}$$

B'

$$B' = \{-4, -3, -2, -1, 0, 1, 2\}$$

Ques-6 Let $S = \{x \mid x \in \mathbb{N}, x \text{ is a factor of } 144\}$,
 $A = \{x \mid x \in \mathbb{N}, x \text{ is a factor of } 24\}$,
 $B = \{x \mid x \in \mathbb{N}, x \text{ is a factor of } 36\}$,
 $C = \{x \mid x \in \mathbb{N}, x \text{ is a factor of } 48\}$
 Find:

$$S = \{1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 144\}$$

$$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$$

$$B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$$

$$C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$$

(i) A'

$$A' = \{9, 16, 18, 36, 48, 72, 144\}$$

(ii) B'

$$B' = \{8, 16, 24, 48, 72, 144\}$$

(iii) C'

$$C' = \{9, 18, 36, 72, 144\}$$

iv.) $A \cup B$

iv.) $A = \{1, 2, 3, 4, 6, 8, 12, 24\}$

$B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

$A \cup B = \{1, 2, 3, 4, 6, 8, 12, 24\} \cup \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

$A \cup B = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36\}$

v.) $B \cup C$

v.) $B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

$C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

$B \cup C = \{1, 2, 3, 4, 6, 9, 12, 18, 36\} \cup \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

$B \cup C = \{1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48\}$

vi.) $A \cup C$

vi.) $A = \{1, 2, 3, 4, 6, 8, 12, 24\}$

$C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

$A \cup C = \{1, 2, 3, 4, 6, 8, 12, 24\} \cup \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

$A \cup C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

vii.) $A \cap B'$

vii.) $A = \{1, 2, 3, 4, 6, 8, 12, 24\}$

$B' = \{8, 16, 24, 48, 144\}$

$A \cap B' = \{1, 2, 3, 4, 6, 8, 12, 24\} \cap \{8, 16, 24, 48, 144\}$

$A \cap B' = \{8, 24\}$

viii.) B

viii.) B
 C

B
 B

ix.) C

ix.) C
 A

C
 C

x.) A

x.) A
 A

A
 B

A
 A

Qu-7 C

A
 A

(i) B

Q.6

$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$
 $B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$
 $C = \{1, 2, 3, 4, 6, 8, 12, 18, 36, 72, 144\}$

$B \cap C = \{1, 2, 3, 4, 6, 9, 12, 18, 36\} \cap \{1, 2, 3, 4, 6, 8, 12, 18, 36, 72, 144\}$
 $B \cap C = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

Q.7

$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$
 $B = \{1, 2, 3, 4, 6, 8, 12, 24\}$

$A - B = \{1, 2, 3, 4, 6, 8, 12, 24\} - \{1, 2, 3, 4, 6, 8, 12, 24\}$
 $A - B = \{\}$

Q.8

$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$
 $B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$
 $C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

$B \cap C = \{1, 2, 3, 4, 6, 9, 12, 18, 36\} \cap \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$
 $B \cap C = \{1, 2, 3, 4, 6, 12\}$

$A - (B \cap C) = \{1, 2, 3, 4, 6, 8, 12, 24\} - \{1, 2, 3, 4, 6, 12\}$
 $A - (B \cap C) = \{8, 24\}$

Q.9 Considering the sets given in Q.6, state whether each of the following statements is true or false:-

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

i) True

$$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$$

$$B \cup C = \{1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48\}$$

$$A \cap (B \cup C) = \{1, 2, 3, 4, 6, 8, 12, 24\} = A$$

ii) ACC

ii) ~~I~~

$$A = \{1, 2, 3, 4, 6, 8, 12, 24\}$$

$$C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$$

ACC (True)

iii) B C C

$$iii) B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$$

$$C = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$$

B C C (false)

[$9 \in B$ but $9 \notin C$]

iv) $A \cap C' = \emptyset$

$$iv) A = \{1, 2, 3, 4, 6, 8, 12, 24\}$$

$$C' = \{9, 18, 36, 72, 144\}$$

$A \cap C' = \emptyset$ True

Ques 8 Let $A = \{a, b, c, d, e\}$, $B = \{a, c, e, g\}$ and $C = \{b, c, f, g\}$. Then verify the following identities!

$$B \cup C = C \cup B$$

$$B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

$$B \cup C = \{a, c, e, g\} \cup \{b, e, f, g\}$$

$$B \cup C = \{a, b, c, e, f, g\}$$

$$C \cup B = \{b, e, f, g\} \cup \{a, c, e, g\}$$

$$C \cup B = \{a, b, c, e, f, g\}$$

$$\text{LHS} = \text{RHS}$$

$$B \cup C = C \cup B$$

Hence verified

$$\text{ii)} \quad B \cap C = C \cap B$$

$$\text{ii)} \quad B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

$$B \cap C = \{a, c, e, g\} \cap \{b, e, f, g\}$$

$$B \cap C = \{e, g\}$$

$$C \cap B = \{b, e, f, g\} \cap \{a, c, e, g\}$$

$$C \cap B = \{e, g\}$$

$$\text{LHS} = \text{RHS}$$

$$B \cap C = C \cap B$$

Hence verified

$$\text{iii)} \quad A \cup (B \cap C) = (A \cup B) \cap C$$

$$\text{iii)} \quad A = \{a, b, c, d, e\}$$

$$B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

$$B \cup C = C \cup B$$

$$B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

$$B \cup C = \{a, c, e, g\} \cup \{b, e, f, g\}$$

$$B \cup C = \{a, b, c, e, f, g\}$$

$$C \cup B = \{b, e, f, g\} \cup \{a, c, e, g\}$$

$$C \cup B = \{a, b, c, e, f, g\}$$

$$\text{LHS} = \text{RHS}$$

$$B \cup C = C \cup B$$

Hence verified

$$\text{ii)} \quad B \cap C = C \cap B$$

$$\text{ii)} \quad B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

$$B \cap C = \{a, c, e, g\} \cap \{b, e, f, g\}$$

$$B \cap C = \{e, g\}$$

$$C \cap B = \{b, e, f, g\} \cap \{a, c, e, g\}$$

$$C \cap B = \{e, g\}$$

$$\text{LHS} = \text{RHS}$$

$$B \cap C = C \cap B$$

Hence verified

$$\text{iii)} \quad A \cup (B \cap C) = (A \cup B) \cap C$$

$$\text{iii)} \quad A = \{a, b, c, d, e\}$$

$$B = \{a, c, e, g\}$$

$$C = \{b, e, f, g\}$$

The following are the steps for the derivation of the formula for the area of a circle:

1. Consider a circle of radius r .
2. Divide the circle into many small sectors.
3. Rearrange these sectors to form a shape that resembles a parallelogram.
4. The length of the base of this parallelogram is equal to the circumference of the circle, which is $2\pi r$.
5. The height of this parallelogram is equal to the radius of the circle, which is r .
6. The area of a parallelogram is given by the formula: $\text{Area} = \text{Base} \times \text{Height}$.
7. Substituting the values of the base and height, we get: $\text{Area} = 2\pi r \times r$.
8. Simplifying this, we get the formula for the area of a circle: $\text{Area} = \pi r^2$.

Faint handwritten notes at the top of the page.

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

Faint handwritten notes below the first equation.

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

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

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

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

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

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

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

$$\begin{aligned} \text{ii) } A &= \{a, b, c, d, e\} \\ B &= \{a, c, e, g\} \\ C &= \{b, e, f, g\} \end{aligned}$$

$$\begin{aligned} B \cup C &= \{a, c, e, g\} \cup \{b, e, f, g\} \\ B \cup C &= \{a, b, c, e, f, g\} \end{aligned}$$

$$\begin{aligned} A \cap (B \cup C) &= \{a, b, c, d, e\} \cap \{a, b, c, e, f, g\} \\ A \cap (B \cup C) &= \{a, b, c, e\} \end{aligned}$$

$$\begin{aligned} A \cap B &= \{a, b, c, d, e\} \cap \{a, c, e, g\} \\ A \cap B &= \{a, c, e\} \end{aligned}$$

$$\begin{aligned} A \cap C &= \{a, b, c, d, e\} \cap \{b, e, f, g\} \\ A \cap C &= \{b, e\} \end{aligned}$$

$$\begin{aligned} (A \cap B) \cup (A \cap C) &= \{a, c, e\} \cup \{b, e\} \\ (A \cap B) \cup (A \cap C) &= \{a, b, c, e\} \end{aligned}$$

LHS = RHS

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

Hence verified

Ques 9] Let $A = \{b, c, d, e\}$ and $B = \{d, e, f, g\}$ be two subsets of the universal set $\xi = \{b, c, d, e, f, g\}$. Then verify the following :-

$$\text{ii) } (A \cup B)' = (A' \cap B')$$

$$\begin{aligned} \xi &= \{b, c, d, e, f, g\} \\ A &= \{b, c, d, e\} \\ B &= \{d, e, f, g\} \end{aligned}$$

$$A \cup B = \{b, c, d, e\} \cup \{d, e, f, g\}$$

$$A \cup B = \{b, c, d, e, f, g\}$$

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

$$A' = \{f, g\}$$

$$B' = \{b, c\}$$

$$(A' \cap B') = \{f, g\} \cap \{b, c\} = \phi$$

LHS = RHS

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

Hence verified

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

$$L = \{b, c, d, e\} \cap \{b, c, d, e, f, g\}$$

$$A = \{b, c, d, e\}$$

$$B = \{d, e, f, g\}$$

$$(A \cap B) = \{b, c, d, e\} \cap \{d, e, f, g\}$$

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

$$(A \cap B)' = \{b, c, f, g\}$$

$$A' = \{f, g\}$$

$$B' = \{b, c\}$$

$$(A' \cup B') = \{f, g\} \cup \{b, c\}$$

$$(A' \cup B') = \{f, g, b, c\}$$

LHS = RHS

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

Hence verified

Q-10 Fill in the blanks -

(i) $A \cup A =$

(ii) $A \cap A =$

(iii) $A \cup \emptyset =$

(iv) $A \cap \emptyset =$

(v) $(A \cup B)' =$

(vi) $(A \cap B)' =$

Ques-11 Let $\xi = \{x \mid x \in \mathbb{N}, 4 \leq x < 18\}$ and A, B, C be subsets of ξ given by $A = \{x \mid x \text{ is a multiple of } 2\}$, $B = \{x \mid x \text{ is a multiple of } 3\}$ and $C = \{x \mid x \in \mathbb{N}, x < 11\}$. Then, verify the following :-

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

(ii) $\xi = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17\}$
 $A = \{2, 4, 6, 8, 10, 12, 14, 16\}$
 $B = \{3, 6, 9, 12, 15\}$
 $C = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

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

$A \cup B = \{2, 4, 6, 8, 10, 12, 14, 16\} \cup \{3, 6, 9, 12, 15\}$
 $A \cup B = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16\}$

$(A \cup B)' = \{5, 7, 11, 13, 17\}$

A'
 B'
 CA
 CA
 LH
 CF
 H
 (ii) CF
 ξ
 ξ
 A
 A
 C
 A
 B
 C
 C

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

$$B = \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$(A \cap B)' = \{3, 5, 7, 9, 11, 13, 15, 17\} \cap \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$(A \cap B)' = \{5, 7, 11, 13, 17\}$$

LHS = RHS
 $(A \cup B)' = (A' \cap B')$
 Hence verified

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

$$S = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17\}$$

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

$$B = \{3, 6, 9, 12, 15\}$$

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

$$A \cap B = \{2, 4, 6, 8, 10, 12, 14, 16\} \cap \{3, 6, 9, 12, 15\}$$

$$A \cap B = \{6, 12\}$$

$$(A \cap B)' = \{4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17\}$$

$$A' = \{5, 7, 9, 11, 13, 15, 17\}$$

$$B' = \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$(A' \cup B') = \{5, 7, 9, 11, 13, 15, 17\} \cup \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$(A' \cup B') = \{4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17\}$$

$$ii) A - B = A \cap B'$$

$$iii) \begin{aligned} \xi &= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18\} \\ A &= \{2, 4, 6, 8, 10, 12, 14, 16\} \\ B &= \{3, 6, 9, 12, 15\} \\ C &= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \end{aligned}$$

$$A - B = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{3, 6, 9, 12, 15\}$$

$$A - B = \{2, 4, 8, 10, 14, 16\}$$

$$B' = \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$A \cap B' = \{2, 4, 6, 8, 10, 12, 14, 16\} \cap \{4, 5, 7, 8, 10, 11, 13, 14, 16, 17\}$$

$$A \cap B' = \{4, 8, 10, 14, 16\}$$

$$LHS = RHS$$

$$A - B = A \cap B'$$

Hence verified

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

$$iv) \begin{aligned} \xi &= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17\} \\ A &= \{2, 4, 6, 8, 10, 12, 14, 16\} \\ B &= \{3, 6, 9, 12, 15\} \\ C &= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \end{aligned}$$

$$B \cap C = \{3, 6, 9, 12, 15\} \cap \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$B \cap C = \{3, 6, 9\}$$

$$A \cup (B \cap C) = \{2, 4, 6, 8, 10, 12, 14, 16\} \cup \{3, 6, 9\}$$

$$A \cup B$$

$$A \cup (B \cap C) = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 16\}$$

$$A \cup B = \{2, 4, 6, 8, 10, 12, 14, 16\} \cup \{3, 6, 9, 12, 15\}$$

$$A \cup B = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16\}$$

$$A \cup C = \{2, 4, 6, 8, 10, 12, 14, 16\} \cup \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A \cup C = \{1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 14, 16\}$$

$$(A \cup B) \cap (A \cup C) = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16\} \cap \{1, 2, 3, 4, 6, 7, 8, 9, 10, 12, 14, 16\}$$

$$(A \cup B) \cap (A \cup C) = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 16\}$$

LHS = RHS

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

Hence verified

Exercise 5-D

Multiple choice questions:-

Ques-1 If $A = \{1\}$, which of the following statements is correct:-

Ans-1 $1 \in A$

Ques-2 If $A = \{1, 2, \{3, 4\}\}$, which of the following is a correct statement?

Ans-2 $\{1\} \subset A$

Ques-3 Consider the following statements:-

- 1) Any set A is comparable with itself.
- 2) $\{0\}$ is a singleton set.
- 3) $\{\emptyset\}$ is an empty set.

Of these statements, the correct ones are:-

Ans-3 1 and 2

Ques-4 Total number of elements in the power set of a set A containing n elements is:-

Ans-4 2^n

Ques-5 If a finite set S contains n elements, then the number of non-empty proper subsets of S is

Ans-5 $2(2^{n-1} - 1)$

Ques-6 The number of all possible proper subsets of $\{2, 3, 5\}$ are

7

Ques-7 If $A = \{a, b\}$, then the power set of A is

$\{\emptyset, \{a\}, \{b\}, \{a, b\}\}$

Ques-8 which one of the following is a correct statement?

a) $\emptyset = \emptyset$

b) $\emptyset = \{\emptyset\}$

c) $\emptyset = \{\emptyset, \emptyset\}$

d) $\emptyset = \{\emptyset\}$

Ans-8 (d) option = $\emptyset = \{\emptyset\}$

Ques-9 which one of the following is a correct statement?

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

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

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

d) None of these

Ans-9 None of these

Ques-10 which one of the following is a correct statement?

a) Every subset of an infinite set is infinite.

b) Every set has a proper subset.

c) $\{a, b, c, 1, 2, 3, a, b, c, 1, 2, 3\}$ is an infinite set.

d) Every subset of a finite set is finite.

Ans-10 Every subset of a finite set is finite.

Ques-11 which of the following is a singleton set?

a) $\{x \in \mathbb{R} : x^2 = x\}$

b) $\{x \in \mathbb{N} : 3x = 4\}$

c) $\{x \in \mathbb{R} : x^2 = -1\}$

d) $\{x : x \text{ is an integer which is neither positive nor negative}\}$

Ans-11 $\{x : x \text{ is an integer which is neither positive nor negative}\}$

Ques-12 which one of the following is an infinite set?

a) $\{x : x \text{ is an integer, } x < 1\}$

b) $\{x : x \text{ is a rational number, } 0 < x < 1\}$

c) $\{x : x \text{ is a natural number, } x > 5\}$

d) $\{x : x \text{ is an even prime}\}$

Ans-12 $\{x : x \text{ is an even prime}\}$.

Ques-13 which one of the following is a finite set?

a) $\{x : x \text{ is an integer, } x < 1\}$

b) $\{x : x \text{ is a rational number, } 0 < x < 1\}$

c) $\{x : x \text{ is a natural number, } x > 5\}$

d) $\{x : x \text{ is an even prime}\}$

Ans-13 $\{x : x \text{ is an even prime}\}$

If $A = \{1, 2, 3, 4\}$ and $B = \{5, 7, 6\}$ then $A \cap B = ?$

$\{\emptyset\}$

Let $A = \{0, 1, 3, 4\}$, $B = \{5, 6, 1, 3, 9\}$ and $C = \{0, 1, 2, 3, 9, 13\}$. Then, $(A \cap B) \cup C$ is

$\{0, 1, 2, 3, 9, 13\}$

Let $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$. Then, $(A \cup B) \cap C$ is

$\{3, 4, 5, 6\}$

If A has 3 elements and B has 6 elements then the minimum and maximum number of elements in $A \cup B$ are respectively

6 and 9

If A has 3 elements and B has 6 elements then the minimum and maximum number of elements in $A \cap B$ are respectively.

0 and 3

Consider the following statements:-

1) $(A \cup B)' = A' \cup B'$

2) $(\emptyset)' = \emptyset$

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

4) $\emptyset' = \emptyset$

DATE

of these 6 statements
Ans 3 and 4 are correct

Q-20 If $A \subset B$, then $A \cap B$ is equal to

Ans A

Q-21 If $A \subseteq B$, then $A \cup B$ is equal to

Ans B