Date: 9/10/2021

Q1. Write $\{x : x$ is an integer and $-1 < x < 10\}$ in roaster type form.

Q2. Write $\{x : x$ is an odd integer and $11 < x < 20\}$ in roaster type form.

Q3. Write $\{x : x$ is an square of an odd integer and $10 < x < 100\}$ in roaster form.

Q4. List the element of the set $A = \left\{x : x \text{ is an integer } \frac{-1}{2} < x < \frac{9}{2}\right\}$.

Q5. Express the set $D = \left\{x : x = \frac{n^2 - 1}{n^2 + 1}, n \in N \text{ and } n < 4\right\}$ in roaster type form.

O6. Describe the set of vowels in the word "MATHEMATICS" in roaster form.

O7. Describe the set of vowels in the word "TEACHERHAND" in roaster form.

O8. Describe the set of vowels in the word "EDUCATION" in roaster form.

Q9. "The set of all odd natural number" represent this statement in set builder form.

Q10. "The set of all even natural numbers" represent this statement in set builder form.

Q11. Let $A = \{x : x \in N$ and x is a prime$\}$ state whether it is finite or infinite set?

Q12. Let $A = \{x : x \in N$ and x is a multiple of 2 and 3 such that $25 < x < 40\}$ in roaster form.

Q13. Let $A = \{x : x \in N, x^2 + 1 = 0\}$, state whether it is empty set or not?

Q14. Let A = Set of the letters in the word "ALLOY".
B = Set of letters in the word "LOYAL" state whether both are equal sets or not?

Q15. Let A = set of the letters in the word "TEACHER"
B = Set of the letters in the word "CHEATER".
State whether both are equal sets or not?

Q16. Let $C = \{x : x \in Z, x^2 \leq 4\}$ and $D = \{x : x \in Z, x^2 - 4 = 0\}$, whether $C = D$?

Q17. Let K = {set of all lines parallel to X axis}. What can you say about set k, finite or infinite?

Q18. $F = \{x : x \in W, \quad x + 3 < 3\}$, state whether it is an empty set?

Q19. Let $P = \{x : x^2 - 1 = 0, x$ is a square of an integer$\}$.
Is P a singleton set? Justify your answer.

Q20. Write the following sets in the roster form:

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

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

Q21. Write the following sets in the roster form:

(i) A = {x : x is a two digit natural number such that sum of its digits is 8}

(ii) B = {x : x is a prime number which is a divisor of 60}.

Q22. Write the following sets in the roster form:

(i) A = The set of all letters in the word TRIGONOMETRY

(ii) B = The set of all letters in the word BETTER.

Q23. Write the following sets in the set builder form:

(i) {3, 6, 9, 12}   (ii) {2, 4, 8, 16, 32}

Q24. Write the following sets in the set builder form:

(i) {5, 25, 125, 625}.   (ii) {2, 4, 6, ..., ...}   (iii) {1, 4, 9, ...,, 100}

Q25. List all the elements of the following sets:

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

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

Q26. List all the elements of the following sets:

(i) A = {x : x is an integer, $x^2 \le 4$}.

(ii) B = {x : x is a letter in the word "LOYAL"}.

Q27. List all the elements of the following sets:

(i) A = {x : x is a month of a year not having 31 days}.

(ii) B = {x : x ia a consonant in the English alphabet which preecedes k}.

Q28. Which of the following are examples of the null set?

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

(ii) Set of even prime numbers.

Q29. Which of the following are examples of the null set?

(i) {x : x is a natural numbers, $x < 5$ and $x > 7$}.

(ii) {y : y is point common to any parallel lines}.

Q30. In the following sets check whether $A = B$ or not:

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

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

Q31. State whether each of the following sets are finite or infinite:

(i) {1, 2, 3, ..., 99, 100}.

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

Q32. Find the union of the following pairs of set:

A = {a, e, i, o, u} B = {a, b, c}

Q33. Find the union of the following pairs of set:

X = {1, 3, 5} Y = {1, 2, 3}

Q34. What universal set would you propose for each of the following:

(i) The set of right triangles. (ii) The set of isosceles triangles.

Q35. Write the following intervals in set builder form: (i) (6, 12], (ii) [– 23, 5).

Q36. Write the following intervals in set builder form: (i) (– 3, 0), (ii) [6, 12].

Q37. Write the following as intervals:

(i) $\{x : x \in R,\ 0 < x < 7\}$ (ii) $\{x : x \in R,\ 3 < x < 4\}$

Q38. Write the following as intervals:

(i) $\{x : x \in R,\ -4 < x < 6\}$ (ii) $\{x : x \in R,\ -12 < x < -10\}$

Q39. Write down the subset of the following subset: (i) {1, 2, 3}, (ii) ϕ.

Q40. Write down the subset of the following sets: (i) $\{a\}$, (ii) $\{a, b\}$.

Q41. Find the union of the following pairs of set:

$A = \{x : x$ is a natural number and $1 < x \leq 6\}$

$B = \{x : x$ is a natural number and $6 < x < 10\}$.

Q42. Find the union of the following pairs of set:

$A = \{x : x$ is a natural number and multiple of 3$\}$

$B = \{x : x$ is a natural number less than 6$\}$.

Q43. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{5, 6, 7, 8\}$. Find $A \cup B \cup C$.

Q44. If $A = \{1, 2, 3, 4\}$, $B = \{7, 8, 9, 10\}$. Find $A \cup B$.

Q45. If $A = \{3, 4, 5, 6\}$, $B = \{5, 6, 7, 8\}$. Find $A \cup B$.

Q46. If $A = \{1, 2, 3, 4\}$, $B = \{5, 6, 7, 8\}$. Find $A \cup B$.

Q47. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$. Find $A \cup B$.

Q48. If A and B are two sets such that $A \subset B$, then what is $A \cup B$?

Q49. Let $A = \{a, b\}$ and $B = \{a, b, c\}$. Is $A \subset B$? What is $A \cup B$?

Q50. Find the union of the following pairs of set:

$A = \{1, 2, 3\}$ $B = \phi$.

Q51. Let $A = \{2, 4, 6, 8, 10, 12, 14, 16\}$ and $B = \{4, 8, 12, 16, 20\}$. Find $A - B$.

Q52. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{5, 10, 15, 20\}$. Find $B - A$.

Q53. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{2, 4, 6, 8, 10, 12, 14, 16\}$. Find $B - A$.

Q54. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{4, 8, 12, 16, 20\}$. Find $B - A$.

Q55. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{5, 10, 15, 20\}$. Find $A - B$.

Q56. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{2, 4, 6, 8, 10, 12, 14, 16\}$. Find $A - B$.

Q57. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$ and $B = \{4, 8, 12, 16, 20\}$. Find $A - B$.

Q58. Let $A = \{x : x$ is an odd natural number$\}$, $B = \{ x : x$ is a prime number$\}$. FInd $A \cap B$.

Q59. Let $A = \{x : x$ is an even natural number$\}$, $B = \{ x : x$ is a prime number$\}$. FInd $A \cap B$.

Q60. Let $A = \{x : x$ is an even natural number$\}$, $B = \{x : x$ is an odd natural number$\}$. FInd $A \cap B$.

Q61. Let $A = \{x : x$ is a natural number$\}$, $B = \{ x : x$ is a prime number$\}$. Find $A \cap B$.

Q62. Let $A = \{x : x$ is a natural number$\}$, $B = \{x : x$ is an odd natural number$\}$. Find $A \cap B$.

Q63. Let $A = \{x : x$ is a natural number$\}$, $B = \{x : x$ is an even natural number$\}$. Find $A \cap B$.

Q64. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$, $C = \{11, 13, 15\}$ and $D = \{15, 17\}$. Find $(A \cup D) \cap (B \cup C)$.

Q65. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$ and $C = \{11, 13, 15\}$. Find $(A \cap B) \cap (B \cup C)$.

Q66. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$ and $C = \{15, 17\}$. Find $A \cap (B \cup C)$.

Q67. If $A = \{3, 5, 7, 9, 11\}$ and $B = \{15, 17\}$. Find $A \cap B$.

Q68. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$ and $C = \{11, 13, 15\}$. Find $A \cap (B \cup C)$.

Q69. If $A = \{7, 9, 11, 13\}$ and $B = \{15, 17\}$. Find $A \cap B$.

Q70. If $A = \{3, 5, 7, 9, 11\}$ and $B = \{11, 13, 15\}$. Find $A \cap B$.

Q71. If $A = \{3, 5, 7, 9, 11\}$, $B = \{11, 13, 15\}$ and $C = \{15, 17\}$. Find $A \cap B \cap C$.

Q72. If $A = \{7, 9, 11, 13\}$ and $B = \{11, 13, 15\}$. Find $A \cap B$.

Q73. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$. Find $A \cap B$.

Q74. Find the intersection of each pairs of sets of following question:

(i) $A = \{x : x$ is a natural number and muiltiple of $3\}$
$B = \{x : x$ is a natural number less than $6\}$.

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

Q75. Find the intersection of each pairs of sets of following question:

(i) $X = \{1, 3, 5\}$ $Y = \{1, 2, 3\}$ (ii) $A = \{a, e, i, o, u\}$ $B = \{a, b, c\}$

(iii) $A = \{1, 2, 3\}$ $B = \phi$.

Q76. If $A = \{3, 4, 5, 6\}$, $B = \{5, 6, 7, 8\}$, $C = \{7, 8, 9, 10\}$. Find $A \cup B \cup C$.

Q77. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{7, 8, 9, 10\}$. Find $A \cup B \cup C$.

Q78. In the following, determine whether the statement is true or false. If it is true, prove it. If it is false, give an example.

(i) If $x \in A$ and $A \not\subset B$, then $x \in B$ (ii) If $A \subset B$ and $x \notin B$, then $x \notin A$

Q79. In the following, determine whether the statement is true or false. If it is true, prove it. If it is false, give an example.

(i) If $A \subset B$ and $B \subset C$, then $A \subset C$ (ii) If $A \not\subset B$ and $B \not\subset C$, then $A \not\subset C$

Q80. In the following, determine whether the statement is true or false. If it is true, prove it. If it is false, give an example.

(i) If $x \in A$ and $A \in B$, then $x \in B$ (ii) If $A \subset B$ and $B \in C$, then $A \in C$

Q81. Show that $A \cup B = A \cap B$ implies $A = B$.

Q82. List all the subsets of the set $\{-1, 0, 1\}$.

Q83. Show that the set of letters needed to spell "CATARACT" and the set of letters needed to spell "TRACT" are equal.

Q84. If R is the set of real numbers and Q is the set of rational numbers, then what is $R - Q$?

Q85. Let $A = \{2, 4, 6, 8, 10, 12, 14, 16\}$ and $B = \{5, 10, 15, 20\}$. Find $B - A$.

Q86. Let $A = \{2, 4, 6, 8, 10, 12, 14, 16\}$ and $B = \{5, 10, 15, 20\}$. Find $A - B$.

Q87. Let $A = \{4, 8, 12, 16, 20\}$ and $B = \{5, 10, 15, 20\}$. Find $B - A$.

Q88. Let $A = \{4, 8, 12, 16, 20\}$ and $B = \{2, 4, 6, 8, 10, 12, 14, 16\}$. Find $B - A$.

Q89. Let $A = \{4, 8, 12, 16, 20\}$ and $B = \{5, 10, 15, 20\}$. Find $A - B$.

Q90. Show that if $A \subset B$, then $C - B \subset C - A$.

Q91. Let $T = \{x : \sin x = 1\}$. State whether T is finite or infinite.

Q92. From the following sets select equal sets.
$A = \{2, 4, 6, 8\}$, $B = \{1, 2, 3, 4, 5\}$, $C = \{-2, 4, 6, 8\}$, $D = \{2, 3, 5, 4, 1\}$, $E = \{8, 6, 2, 4\}$.

Q93. Let $T = \left\{x : \frac{x+5}{x-7} - 5 = \frac{4x-40}{13-x}\right\}$ is T is an empty set? Justify your answer.

Q94. Equal sets are always equivalent. But equivalent sets need not be equal justify statement by example.

Q95. Express the set $D = \left\{x : x = \frac{a}{a+b}\right\}$, $\{a, b\} \in$ W and $a < b$, $b < 3\}$ in roaster form.

Q96. Are the following pair of set equal? Give reason.
(a) $A = \{3, 5\}$ and $B = \{x : x$ is a solution of $x^2 + 8x + 15 = 0\}$
(b) $A = \{-3, -5\}$ and $B = \{x : x$ is a solution of $x^2 + 8x + 15 = 0\}$

Q97. Rewrite the following statements using notations?
(a) a is an element of A.
(b) b is not an element of A.
(c) A is an empty set and B is a non empty set.
(d) Number of elements in A is 6.
(e) 0 is whole number but not a natural number.

Q98. Which of the following sets are empty?
(a) $A = \{x : x \in N$ and $x \leq 1\}$
(b) $B = \{x : 3x + 1 = 0, x \in N\}$
(c) $C = \{x : 2 < x < 3, x \in N\}$

Q99. Which of the following collections are set? Justify your answer.

(a) A collection of 11 best hockey players of India.

(b) The collection of all books on mathematics.

(c) The collection of all interesting books.

(d) The collection of all rich people of DELHI.

Q100 Decide, among the folowing sets, which sets are subsets of one another: $A = \{x : x \in R$ and x satisfy $x^2 - 8x + 12 = 0\}$, $B = \{2, 4, 6\}$, $C = \{2, 4, 6, 8, ...\}$, $D = \{6\}$.

Q101 If $X = \{a, b, c, d\}$ and $Y = \{f, b, d, g\}$, find

(i) $X - Y$ (ii) $Y - X$ (iii) $X \cap Y$.

Q102 State whether each of the following sets is finite or infinite.

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

(ii) The set of letters in English alphabet.

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

(iv) The set of animals living on Earth.

Q103 State which of the following are finite and which are infinite?

(a) $\{x : x \in N$ and $x^2 < 36\}$

(b) $\{x : x \in N$ and x is even$\}$

(c) Set of numbers which are multiple of 7.

(d) Set of animals living on earth.

Q104 Which of the following are empty sets.

(a) $\{x : x \in N$ and $x + 6 = 6\}$

(b) $\{x : x \in W$ and $x + 8 = 8\}$

(c) $x : x \in N, x < 5$ and $x > 8$

(d) $\{x : x \in N$ and $x^2 = x\}$

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S1. {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.

S2. {13, 15, 17, 19}

S3. {25, 49, 81}

S4. A = {0, 1, 2, 3, 4}

S5. $D = \left\{0, \frac{3}{5}, \frac{4}{5}\right\}$

S6. The word "MATHEMATICS" has following vowels *A*, *E*, *I*.
Hence required set is {*A*, *E*, *I*}

S7. The word "TEACHERHAND" has following vowels *E*, *A*.
Hence required set is {*E*, *A*}

S8. The word "EDUCATION" has following vowels "*A*, *E*, *I*, *O*, *U*"
Hence required set is {*A*, *E*, *I*, *O*, *U*}.

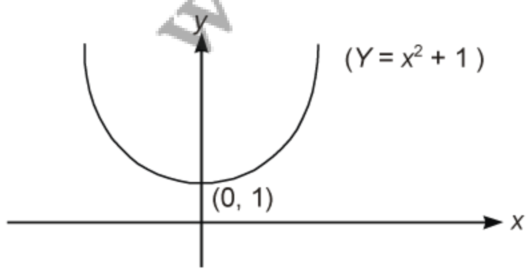
S9. An odd natural number can be written in the form $(2n - 1)$.
Hence, given set can be described in set builder form as $\{x : x = 2n - 1, n \in N\}$

S10. An even natural number can be written in the form $2n$.
Hence given set can be described in set builder form as $\{x : x = 2n, n \in N\}$.

S11. Set of prime number is an infinite set.

S12. Since required elements are 30, 36 only.
Hence, required set is {30, 36}.

S13. Since $x^2 + 1$ is always non negative.
Hence, it is empty set.



S14. Since $A = \{A, L, O, Y\}$

$B = \{A, L, O, Y\}$

Hence both are equal set.

S15.

$$A = \{\text{T, E, A, C, H, R}\}.$$
$$B = \{\text{T, E, A, C, H, R}\}$$

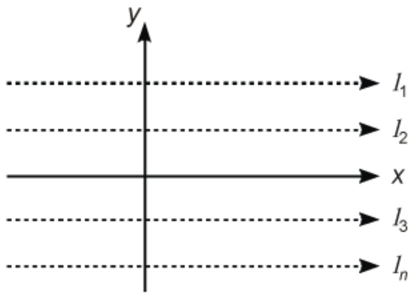
Hence, both are equal sets.

S16.

$$x^2 \le 4 \quad \Rightarrow \quad x = 1, 2, 0, -1, -2$$
$$x^2 - 4 = 0 \quad \Rightarrow \quad (x - 2)(x + 2) = 0 \quad \Rightarrow \quad x = +2, -2$$

Hence from above discussion we can say that set C is not equal to set D.

S17.



From the above graph it is obvious that k is an infinite set.

S18.

$$x + 3 < 3 \quad \Rightarrow \quad x < 0$$

Clearly x is an empty set.

S19.

$$x^2 - 1 = 0 \quad \Rightarrow \quad (x - 1)(x + 1) = 0$$

$\Rightarrow$ $\qquad x = 1, -1$

$\because$ $\qquad x = \{1, -1\}$

Hence P is not a singleton set.

S20. (i) $A = \{-3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$

(ii) $B = \{1, 2, 3, 4, 5\}$

S21. (i) $A = \{17, 26, 35, 44, 53, 62, 71, 80\}$

(ii) $B = \{2, 3, 5\}$

S22. (i) $A = \{\text{T, R, I, G, O, N, M, E, Y}\}$

(ii) $B = \{\text{B, E, T, R}\}$

S23. (i) $A = \{x : x$ is a natural number multiple of 3 and $x < 15\}$

(ii) $A = \{x : x = 2^n, n \in N \text{ and } n < 6\}$.

S24. (i) $A = \{x : x = 5^n, n \in N \text{ and } n \le 4\}$. (ii) $A = \{x : x$ is an even natural number$\}$.

(iii) $A = \{x : x = n^2, n \in N \text{ and } n < 11\}$.

S25. (i) $A = \{1, 3, 5, 7, ...\}$. (ii) $B = \{0, 1, 2, 3, 4\}$.

S26. (i) $A = \{-2, -1, 0, 1, 2\}$. (ii) $B = \{\text{L, O, Y, A}\}$.

S27. (i) A = {February, April, June, September, November}.

(ii) $B = \{b, c, d, f, g, h, j\}$.

S28. (i) Yes, null set.

(ii) No, since 2 is a even prime number.

S29. (i) There is no natural number such that $x < 5$ and as well as $x > 7$.

(ii) Parallel lines, never meet at a finite point.

S30. (i) $A = B$ (ii) $A \neq B$

S31. (i) {1, 2, 3, ..., 99, 100}.

It is a ***finite set*** as it containes, first 100 natural numbers.

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

It is an ***infinite set*** since there are infinite number of positive integers *viz*., 101, 102, 103, ... greater than 100.

S32. $A \cup B = \{a, e, i, o, u\} \cup \{a, b, c\} = \{a, b, c, e, i, o, u\}$

S33. $X \cup Y = \{1, 3, 5\} \cup \{1, 2, 3\} = \{1, 2, 3, 5\}$

S34. The set of all the possible triangles is the universal set for each of the given sets.

S35. (i) $(6, 12] = \{x : x \in R,\ 6 < x \leq 12\}$. (ii) $[-23, 5) = \{x : x \in R,\ -23 \leq x < 5\}$.

S36. (i) $(-3, 0) = \{x : x \in R,\ -3 < x < 0\}$. (ii) $[6, 12] = \{x : x \in R,\ 6 \leq x \leq 12\}$.

S37. (i) (0, 7) (ii) (3, 4)

S38. (i) $(-4, 6)$ (ii) $(-12, -10)$

S39. (i) ϕ, {1}, {2}, {3}, {1, 2}, {2, 3}, {1, 3}, {1, 2, 3}. (ii) ϕ.

S40. (i) ϕ, $\{a\}$. (ii) ϕ, $\{a\}$, $\{b\}$, $\{a, b\}$.

S41. $A \cup B = \{2, 3, 4, 5, 6\} \cup \{7, 8, 9\} = \{2, 3, 4, 5, 6, 7, 8, 9\}$.

S42. $A \cup B = \{3, 6, 9, ...\} \cup \{1, 2, 3, 4, 5\} = \{1, 2, 3, 4, 5, 6, 9, 12, 15, ...\}$.

S43.
$$A \cup B \cup C = \{1, 2, 3, 4\} \cup \{3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$$
$$= \{1, 2, 3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$$
$$= \{1, 2, 3, 4, 5, 6, 7, 8\}.$$

S44.
$$A \cup B = \{1, 2, 3, 4\} \cup \{7, 8, 9, 10\}$$
$$= \{1, 2, 3, 4, 7, 8, 9, 10\}.$$

S45.
$$A \cup B = \{3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$$
$$= \{3, 4, 5, 6, 7, 8\}.$$

S46.
$$A \cup B = \{1, 2, 3, 4\} \cup \{5, 6, 7, 8\}$$
$$= \{1, 2, 3, 4, 5, 6, 7, 8\}$$

S47. $A \cup B = \{1, 2, 3, 4\} \cup \{3, 4, 5, 6\}$

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

S48. Since, A is a subset of B, therefore, every element of set A is contained in the set B and hence $A \cup B = B$.

S49. Yes, $A \subset B$, because every element of A is also an element of B, and $A \cup B = \{a, b\} \cup \{a, b, c\} = \{a, b, c\}$.

S50. $A \cup B = \{1, 2, 3\} \cup \phi = \{1, 2, 3\}$.

S51. $A - B = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{4, 8, 12, 16, 20\}$

$= \{20\}$.

S52. $B - A = \{5, 10, 15, 20\} - \{3, 6, 9, 12, 15, 18, 21\}$

$= \{5, 10, 20\}$.

S53. $B - A = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{3, 6, 9, 12, 15, 18, 21\}$

$= \{2, 4, 8, 10, 14, 16\}$.

S54. $B - A = \{4, 8, 12, 16, 20\} - \{3, 6, 9, 12, 15, 18, 21\}$

$= \{4, 8, 16, 20\}$.

S55. $A - B = \{3, 6, 9, 12, 15, 18, 21\} - \{5, 10, 15, 20\}$

$= \{3, 6, 9, 12, 18, 21\}$.

S56. $A - B = \{3, 6, 9, 12, 15, 18, 21\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$

$= \{3, 9, 15, 18, 21\}$.

S57. $A - B = \{3, 6, 9, 12, 15, 18, 21\} - \{4, 8, 12, 16, 20\}$

$= \{3, 6, 9, 15, 18, 21\}$.

S58. Given: $A = \{1, 3, 5, 7, ...\}$ $B = \{2, 3, 5, 7, 11, 13 ...\}$

$A \cap B = \{1, 3, 5, 7, ...\} \cap \{2, 3, 5, 7, 11, 13 ...\}$

$= \{3, 5, 7, 11, 13, 17, 19, ...\}$

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

S59. Given: $A = \{2, 4, 6, 8, ...\}$ $B = \{2, 3, 5, 7, 11, 13 ...\}$

$A \cap B = \{2, 4, 6, 8, ...\} \cap \{2, 3, 5, 7, 11, 13 ...\}$

$= \{2\}$.

S60. Given: $A = \{2, 4, 6, 8, ...\}$ $B = \{1, 3, 5, 7, ...\}$

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

$= \phi$.

S61. Given: $A = \{1, 2, 3, 4, ...\}$ $B = \{2, 3, 5, 7, 11, 13 ...\}$

$A \cap B = \{1, 2, 3, 4, ...\} \cap \{2, 3, 5, 7, 11, 13 ...\}$

$= \{2, 3, 5, 7, 11, 13 ...\} = B$.

S62. Given: $A = \{1, 2, 3, 4, ...\}$ $B = \{1, 3, 5, 7, ...\}$

$$A \cap B = \{1, 2, 3, 4, ...\} \cap \{1, 3, 5, 7, ...\}$$
$$= \{1, 3, 5, 7, ...\} = B.$$

S63. Given: $A = \{1, 2, 3, 4, ...\}$ $B = \{2, 4, 6, 8, ...\}$

$$A \cap B = \{1, 2, 3, 4, ...\} \cap \{2, 4, 6, 8, ...\}$$
$$= \{2, 4, 6, 8, ...\} = B.$$

S64.

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

$$B \cup C = \{7, 9, 11, 13, 15\}$$

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

S65.

$$A \cap B = \{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13\}$$
$$= \{7, 9, 11\}$$

$$B \cup C = \{7, 9, 11, 13\} \cup \{11, 13, 15\}$$
$$= \{7, 9, 11, 13, 15\}$$

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

S66.

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

S67.

$$A \cap B = \{3, 5, 7, 9, 11\} \cap \{15, 17\}$$
$$= \phi.$$

S68.

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

S69.

$$A \cap B = \{7, 9, 11, 13\} \cap \{15, 17\}$$
$$= \phi.$$

S70.

$$A \cap B = \{3, 5, 7, 9, 11\} \cap \{11, 13, 15\}$$
$$= \{11\}.$$

S71.

$$A \cap B \cap C = \{3, 5, 7, 9, 11\} \cap \{11, 13, 15\} \cap \{15, 17\}$$
$$= \{11\} \cap \{15, 17\} = \phi.$$

S72.

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

S73. $A \cap B = \{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13\}$

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

S74. (i) $A \cap B = \{3, 6, 9, ...\} \cap \{1, 2, 3, 4, 5\} = \{3\}$.

(ii) $A \cap B = \{2, 3, 4, 5, 6\} \cap \{7, 8, 9\} = \phi$.

S75. (i) $X \cap Y = \{1, 3, 5\} \cap \{1, 2, 3\} = \{1, 3\}$. (ii) $A \cap B = \{a, e, i, o, u\} \cap \{a, b, c\} = \{a\}$.

(iii) $A \cap B = \{1, 2, 3\} \cap \phi = \phi$.

S76. $A \cup B \cup C = \{3, 4, 5, 6\} \cup \{5, 6, 7, 8\} \cup \{7, 8, 9, 10\}$

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

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

S77. $A \cup B \cup C = \{1, 2, 3, 4\} \cup \{3, 4, 5, 6\} \cup \{7, 8, 9, 10\}$

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

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

S78. (i) **False.** Let $A = \{1, 2\}$, $B = \{2, 3, 4, 5\}$.

Clearly, $1 \in A$ and $A \subset B$, but $1 \notin B$.

Thus, $x \in A$ and $A \not\subset B$ need not imply that $x \in B$.

(ii) **True.** Let $A \subset B$. Then clearly, $x \in A \Rightarrow x \in B$.

Now, $x \notin B \Rightarrow x \notin A$. **Proved.**

S79. (i) **True.** Let $x \in A$. Then,

$A \subset B \Rightarrow x \in B \Rightarrow x \in c\,[B \quad C]$

Thus, $x \in A \Rightarrow x \in C$ for all $x \in A \Rightarrow x \subset C$.

Hence, $A \subset B$ and $B \subset C$, $A \subset C$. **Proved.**

(ii) **False.** Let $A = \{1, 2\}$, $B = \{2, 3\}$ and $C = \{1, 2, 5\}$

Then, $A \not\subset B$ and $B \not\subset C$, but $A \subset C$.

Thus, $A \not\subset B$ and $B \not\subset C$ need not imply that $A \not\subset C$.

S80. (i) **False.** *e.g.*, Let $A = \{1\}$, $B = \{(1), 2\}$

Clearly, $1 \in A$ and $A \in B$, but $1 \in B$.

Hence, $x \in A$ and $A \in B$ need not imply that $x \in B$.

(ii) **False.** *e.g.*, Let $A = \{1\}$, $B = \{1, 2\}$ and $C = \{\{1, 2\}, 3\}$

Clearly, $A \subset B$ and $B \in C$, but $A \notin C$.

Hence, $A \subset B$ and $B \in C$ need not imply that $A \in C$.

S81. Let $a \in A$. Then $a \in A \cup B$. Since $A \cup B = A \cap B$, $a \in A \cap B$. So, $a \in B$. Therefore, $A \subset B$. Similarly, if $b \in B$, then $b \in A \cup B$. Since

$A \cup B = A \cap B$, $a \in A \cap B$. So $b \in A$. Therefore, $B \subset A$. Thus $A = B$.

S82. Let $A = \{-1, 0, 1\}$. The subset of A having no element is the empty set ϕ. The subsets of A having one element are $(-1\}$, $\{0\}$, $\{1\}$. The subsets of elements of A is A itself. So, all the subsets of A are ϕ, $\{-1\}$, $\{0\}$, $\{1\}$, $\{-1, 0\}$, $(-1, 1\}$, $\{0, 1\}$, $\{-1, 0, 1\}$.

S83. Let X be the set of letters in "CATARACT". Then

$$X = \{C, A, R, T\}$$

Let Y be the set of letters in "TRACT". Then

$$Y = \{T, R, A, C, T\} = \{T, R, A, C\}$$

Since every element in X is in Y and every element in Y is in X. It follows that $X = Y$.

S84. Since, set of real numbers contains a set of rational numbers and a set of irrational numbers.

$\therefore \quad R - Q$ = a set of irrational numbers.

S85.
$$B - A = \{5, 10, 15, 20\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$$
$$= \{5, 15, 20\}.$$

S86.
$$A - B = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{5, 10, 15, 20\}$$
$$= \{2, 4, 6, 8, 12, 14, 16\}.$$

S87.
$$B - A = \{5, 10, 15, 20\} - \{4, 8, 12, 16, 20\}$$
$$= \{5, 10, 15\}.$$

S88.
$$B - A = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{4, 8, 12, 16, 20\}$$
$$= \{2, 6, 10, 14\}.$$

S89.
$$A - B = \{4, 8, 12, 16, 20\} - \{5, 10, 15, 20\}$$
$$= \{4, 8, 12, 16\}.$$

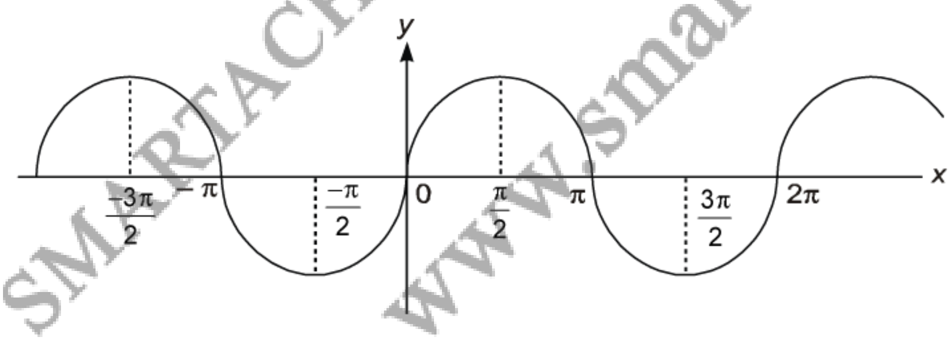
S90. Let $x \in C - B \Rightarrow x \in C$, but $x \notin B$,

$\Rightarrow \quad x \in C$ but $x \in A \qquad [A \subset B]$

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

Hence, $C - B \subset C - A$. **Proved.**

S91.



$$x = \left\{\frac{\pi}{2}, \frac{5\pi}{2}, \frac{9\pi}{2}, \frac{-3\pi}{2}, \ldots\right\}$$

Clearly from the above graph we can say that T is an infinite set.

S92. "Two sets are said to be equal, if they have exactly the same elements"

$$A = \{2, 4, 6, 8\} \quad \text{and} \quad E = \{8, 6, 2, 4\}.$$

Since each element of set A also present in set E.

Therefore A and E are equal sets.

Similarly, $B = \{1, 2, 3, 4, 5\}$ and $D = \{2, 3, 5, 4, 1\}$

Since each element of set B also present in set D.

Therefore B and D are equal sets.

S93. $\because$

$$\frac{x+5}{x-7} - 5 = \frac{4x-40}{13-x}$$

$$\Rightarrow \quad \frac{x+5}{x-7} - \frac{5}{1} = \frac{4x-40}{13-x}$$

$$\Rightarrow \quad \frac{40-4x}{x-7} = \frac{4x-40}{13-x}$$

$$\Rightarrow \quad (4x-40)\left[\frac{1}{(13-x)} + \frac{1}{x-7}\right] = 0$$

$$\Rightarrow \quad 4x - 40 = 0 \quad \Rightarrow \quad x = 10$$

Hence, T is not an empty set.

S94. Two finite set A and B are said to the equivalent if $n(A) = n(B)$.

Example: Let $A = \{1, 3, 5\}$ and $B = \{2, 4, 6\}$, then $n(A) = n(B) = 3$

So, A and B are equivalent clearly $A \neq B$.

Thus, A and B are equivalent but not equal. Hence the problem.

S95. Since possible ordered pair of, $\langle 0, 1\rangle$, $\langle 1, 2\rangle$, $\langle 2, 3\rangle$, $\langle 0, 2\rangle$, $\langle 0, 3\rangle$, $\langle 1, 3\rangle$,

Since total no. of ordered pair for all such , $\langle a, b\rangle$, is 6.

Hence,

required set is $\left\{\frac{0}{0+1}, \frac{1}{1+2}, \frac{2}{2+3}, \frac{0}{0+2}, \frac{0}{0+3}, \frac{1}{1+3}\right\} \Rightarrow \left\{0, \frac{1}{3}, \frac{2}{5}, \frac{1}{4}\right\}$

S96. (a)

$$x^2 + 8x + 15 = 0$$

$$\Rightarrow \quad x^2 + 3x + 5x + 15 = 0$$

$$\Rightarrow \quad x(x + 3) + 5(x + 3) = 0$$

$$\Rightarrow \quad (x + 3)(x + 5) = 0$$

$$x = (-3, -5)$$

Hence, $A \neq B$

(b) Since set $A = \{-3, -5\}$, and solution set $B = \{-3, -5\}$. Hence $A = B$.

S97. (a) $a \in A$

(b) $b \notin A$

(c) $A = \phi$ and $B \neq \phi$

(d) $n(A) = 6$

(e) $0 \in W$ but $0 \notin N$.

S98. *A* set which does not contain any element called empty set.

(a) $$A = \{x : x \in N \text{ and } x \leq 1\}.$$

Since $x \leq 1$ means $x < 1$ and $x = 1$. Which is natural number.

$$\therefore \qquad x = \{1\}$$

So, this is not an empty set.

(b) $$B = \{x : 3x + 1 = 0,\ x \in N\}$$

$$\Rightarrow \qquad 3x + 1 = 0 \quad \Rightarrow \quad x = -\frac{1}{3} \notin N.$$

Hence set *B* does not contain any element. Hence set *B* is an empty set.

(c) $$C = \{x : 2 < x < 3,\ x \in N\}$$

Since there is no natural number between 2 and 3.

Hence, *C* is an empty set.

S99. (a) The term best is vague so the given collection is not a set.

(b) It is clear that the given collection contains definite objects namely all books on mathematics so the given collection is set.

(c) The term interesting is vague so the given collection is not a set.

(d) The term rich people is vague so the given collection is not a set.

S100. We have $$x^2 - 8x + 12 = 0$$

or $$x^2 - 6x - 2x + 12 = 0$$

or $$x(x - 6) - 2(x - 6) = 0$$

or $$(x - 2)(x - 6) = 0$$

or $$x - 2 = 0 \quad \text{or} \quad x - 6 = 0$$

$$x = 2 \quad \text{or} \quad x = 6$$

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

Clearly, every element of *A* are in *B* and *C*. $A \subset B$ and $A \subset C$.

Again, every element of *B* is in *C*. *i.e.*, $B \subset C$.

Also, every element of *D* are in *A*, *B* and *C*. *i.e.*, $D \subset A$, $D \subset B$ and $D \subset C$.

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

S101.(i) $X - Y = \{a, b, c, d\} - \{f, b, d, g\} = \{a, c\}$

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

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

S102.(i) **Infinite**. Infinite lines can be drawn parallel to x-axis.

(ii) **Finite**. It is set of 26 letters

(iii) **Infinite**. {5, 10, 15, ...}

(iv) **Finite**. There are finite number of animals living on Earth.

S103.(a) Let $A = \{x \in N$ and $x^2 < 36\}$. Then $A = \{1, 2, 3, 4, 5\}$ which is clearly finite set.

(b) Set of all even natural no. are infinite set {2, 4, 6, 8, ...}.

(c) Set of all multiple of 7 are infinite set.

(d) Set of all animals on earth is finite set.

S104.(a) $x + 6 = 6 \quad \Leftrightarrow \quad x = 0$, but $0 \notin N$

$\therefore$ Hence it is an empty set.

(b) $\{x : x \in W$ and $x + 8 = 8\} = \{0\}$

Hence it is non empty set.

(c) There is no counting number less than 5 and greater than 8. Hence it is an empty set.

(d) $$x^2 = x \quad \Rightarrow \quad x^2 - x = 0$$

$$\Rightarrow \quad x(x - 1) = 0 \quad \Rightarrow \quad x = 0, 1.$$

Clearly it is non empty set ($I \in N$)

Date: 9/10/2021

Q1. Let $A = \{1, 3, 5\}$ write all subset of A.

Q2. Let A is the set of vowels in the word "TRIGONOMETRY". Write all subsets of A.

Q3. Write all subset of set A. Given that $A = \{x : x \text{ is an integer and } 0 < x < 2\}$.

Q4. Write down all possible subsets of $\{-1, 0, 1\}$.

Q5. Let $A = \{x : x$ is an isosceles triangle in a plane$\}$ and $B = \{x : x$ is an equilateral triangle in same plane$\}$. State whether $A \subsetneq B$ or $A \subseteq B$.

Q6. Let $A = [1, 3]$ write A in set builder form.

Q7. Let $B = \{x : x$ is an English alphabet lying between b and $m\}$. How many subset of B may exist.

Q8. Let $A =]1, 5[$. Write A in set builder form.

Q9. Let $B =]1, 10]$. Write B in set builder form.

Q10. Let A = set of all circle in a plane, B = set of all circles of unit radius in the same plane. State whether $A \subseteq B$ or $B \subseteq A$.

Q11. Write down all possible subsets of ϕ.

Q12. Let $A = \{x : x \in R, -4 < x < 0\}$. Express set A in interval form.

Q13. Let $C = \{x : x \in R, 2 < x \leq 6\}$. Express set C in interval form.

Q14. Let $A = \{a, b, c\}$, write power set of A.

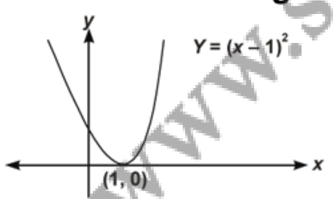
Q15. If $F = \{2, \{3\}\}$, write down all subset of F.

Q16. If $A = \{1, 2, 3\}$, find $P(A)$ and $n(P(A))$.

Q17. Let $A = \{1\}$, $B = \{1, 2\}$, state whether $A \subsetneq B$ or not.

Q18. Let $A = \{1\}$, $B = \{\{1\}, 2\}$, state whether $A \subseteq B$ or not.

Q19. Let $S = \{x : (x - 1)^2 = 0\}$, state where S is singleton set or not.



Q20. Which of the following are sets? Justify your answer.

(i) A team of eleven best cricket batsmen of the world.

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

Q21. Which of the following are sets? Justify your answer.

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

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

Q22. Which of the following are sets? Justify your answer.

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

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

Q23. Let U be the set of all triangles in a plane. If A is the set of all triangles with at least one angle different from 60°, what is A'?

Q24. Let $A = \{a, e, i, o, u\}$ and $B = \{a, b, c, d\}$. Is A a subset of B? No. Is B a subset of A? No.

Q25. Consider the sets

$$\phi,\ A = \{1, 3\},\quad B = \{1, 5, 9\},\quad C = \{1, 3, 5, 7, 9\}.$$

Insert the symbol $\subset$ or $\not\subset$ between each of the following pair of sets:

(i) $\phi \ldots B$ (ii) $A \ldots B$ (iii) $A \ldots C$ (iv) $B \ldots C$

Q26. Which of the following pairs of sets are equal? Justify your answer.

(i) X, the set of letters in "ALLOY" and B, the set of letters in "LOYAL".

(ii) $A = \{n : n \in Z \text{ and } n^2 \le 4\}$ and $B = \{x : x \in R \text{ and } x^2 - 3x + 2 = 0\}$.

Q27. Write the set $\left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\right\}$, in the set-builder form.

Q28. Write the set $A = \{1, 4, 9, 16, 25, \ldots\}$ in set-builder form.

Q29. Write the set $\{x : x \text{ is a positive integer and } x^2 < 40\}$ in the roster form.

Q30. Write the solution set of the equation $x^2 + x - 2 = 0$ in roster form.

Q31. Which of the following are sets? Justify your answer.

(i) The collection of all even integers.

(ii) The collection of questions in this chapter.

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

Q32. If $A = \{x : x = n^2, n = 1, 2, 3\}$, then find the number of proper subsets of A.

Q33. Let $A = \{x : x \text{ is a vowel in the word EDUCATION}\}$, then find the total no. of subsets of A.

Q34. Let $A = \{x : x \in Z, x^2 = 1\}$, $B = \{x : x \in N, x^2 = 1\}$. Check whether $A \subsetneq B$ or $B \subseteq A$.

Q35. Write the following subsets of R as interval. Also find the length of interval and represent on the number line $\{x : x \in R, -3 \le x \le 3\}$.

Q36. Write the following subsets of R as interval. Also find the length of interval and represent on number line $\{x : x \in R, -12 \le x \le -10\}$.

Q37. Find the power set of set $A = \{0, 1, 2\}$.

Q38. Prove that $A \subseteq \phi$ implies $A = \phi$.

Q39. Let $A = \{1, 2, 3, 4\}$ write all subsets of A.

Q40. Write down the subset of the following sets.

(a) $\{a, e, i\}$ (b) $\{\phi\}$

Q41. Consider the following sets ϕ, $A = \{1, 2\}$ and $B = \{1, 4, 8\}$. Insert the following symbols $\subset$ or $\not\subset$ between each of the following pair of sets.

(a) ϕ ..... B (b) A ..... B

Q42. If $A = \{a, e, i, o, u\}$, find all possible subsets of A.

Q43. Write down all possible subsets of $A = \{1, \{2, 3\}\}$.

Q44. If $A = \{x : x \in N, 3 < x \leq 9\}$, then find $n(P(A))$.

Q45. Show that $n\{P[P(\phi)]\} = 4$.

Q46. Write the following intervals in the set builder form

(a) $(-6, 0)$ (b) $[3, 21]$ (c) $(-23, 8]$ (d) $(0, 1)$

Q47. Find all possible subsets of $S = \{x : x^3 = 1, x \in R\}$.

Q48. Let $S = \{x : x^3 - 6x^2 + 11x - 6 = 0\}$, find all possible subsets of S.

Q49. State which of the following sets are finite or infinite:

(i) $\{x : x \in N \text{ and } x^2 = 4\}$ (ii) $\{x : x \in N \text{ and } 2x - 1 = 0\}$

(iii) $\{x : x \in N \text{ and } x \text{ is prime}\}$ (iv) $\{x : x \in N \text{ and } x \text{ is odd}\}$

Q50. Find $n(P(A))$ if $A = \{x : x \in R, x^4 - 1 = 0\}$

Q51. If $A = \{x : x \in z^+, x^2 - 5x + 6 = 0\}$, find all subsets of A.

Q52. Let A and B are two sets. Then prove that $A = B \Leftrightarrow A \subseteq B$ and $B \subseteq A$.

Q53. Find the pairs of equal sets, if any, give reasons:

$A = \{0\}$, $B = \{x : x > 15 \text{ and } x < 5\}$

$C = \{x : x - 5 = 0\}$, $D = \{x : x^2 = 25\}$,

$E = \{x : x \text{ is an integral positive root of the equation } x^2 - 2x - 15 = 0\}$.

Q54. If $A = \{3, \{4, 5\}, 6\}$, then find which of the following statements are true:

(a) $\{4, 5\} \subset A$ (b) $\{4, 5\} \in A$ (c) $\phi \subset A$ (d) $\{3, 6\} \subset A$

Q55. Assume that $P(A) = P(B)$. Show that $A = B$.

Date: 9/10/2021

S1. Since we know that a set containing n element having 2^n subsets.

Hence A has $2^3 \Rightarrow 8$ subset which can be written as

$\Rightarrow$ {1}, {3}, {5}, {1, 3}, {1, 5}, {3, 5}, {1, 3, 5}, {ϕ}.

S2. We write set A in Roaster form as

$$A = \{I, O, E\}$$

Hence all subsets of A is

$$\{I\}, \{O\}, \{E\}, \{I, O\}, \{I, E\}, \{O, E\}, \{I, O, E\}, \{\phi\}.$$

S3. We can write set A in Roaster form as

$$A = \{1\}$$

Hence subset of A is {1}, ϕ.

S4. All possible subsets of A are

$$\phi, \{-1\}, \{0\}, \{1\}, \{-1, 0\}, \{-1, 1\}, \{0, 1\}, \{-1, 0, 1\}.$$

S5. Since every equilateral triangle may treated as isosceles but not vice versa.

Hence, $\qquad A \subsetneq B$

S6. $$A = \{x : x \in R, 1 \le x \le 3\}.$$

S7. $$B = \{c, d, e, f, g, h, i, j, k, l\}.$$

Hence total no. of subsets of B are 2^{10}.

S8. Since both extreme values contains open braces hence equality sign does not take place.

$\therefore$ $$A = \{x : x \in R, 1 < x < 5\}.$$

S9. $$B = \{x : x \in R, 1 < x \le 10\}.$$

S10. Since eq. of circle having radius r and centre at (h, k) is

$$(x - h)^2 + (y - k)^2 = r^2$$

Obviously r can take all real values hence $B \subseteq A$ but $A \subsetneq B$.

S11. Total no. of subsets of ϕ is

$$2^{\circ} = 1$$

Hence ϕ has only one subset namely ϕ.

S12. Set A can be represented in interval form as $A =]-4, 0[$.

S13. Set C can be represented in interval form as

$$C =]2, 6]$$

S14. Power set of A is $\{\{a\}, \{b\}, \{c\}, \{a, b\}, \{b, c\}, \{a, c\}, \{a, b, c\}, \phi\}$.

S15. All possible subsets of F are $\{2\}, \{\{3\}\}, \{2, \{3\}\}, \{\phi\}$.

S16. $$P(A) = \{\{1\}, \{2\}, \{3\}, \{1, 2\}, \{2, 3\}, \{1, 3\}, \{1, 2, 3\}, \{\phi\}\}.$$

$\therefore$ $$n(P(A)) = 8$$

S17. Since $1 \in A$ and $1 \in B$

Hence, $$A \subseteq B$$

S18. Since $1 \in A$ but $1 \notin B$

Hence, $$A \not\subseteq B.$$

S19. Clearly, $y = (x - 1)^2$ has only one root $x = 1$.

Hence solution set for S is

$$S = \{1\}, \quad \text{which is clearly a singleton set.}$$

S20. (i) The term 'best' is a vague term. A batsmen may be best to one person and may not be so to the other.

Thus, we cannot judge definitely which batsmen are there in our collection.

$\therefore$ This collection is not well-defined and hence, ***it is not a set***.

(ii) We will definitely say that the members of this collection are your class-fellows.

$\therefore$ This collection is well-defined and hence, ***it is a set***.

S21. (i) We can definitely say that the members of this collection are : January, June, July.

So, this collection is well-defined and hence, ***it is a set***.

(ii) The term 'most talented' is a vague term. A writer may be most talented to one person and may not be so to the other.

Thus, we cannot judge definitely which writers are there in our collection.

$\therefore$ This collection is not well-defined and hence, ***it is not a set***.

S22. (i) Clearly, the members of collection are 1, 2, 3, ..., 97, 98, 99.

$\therefore$ This collection is well-defined and hence, ***it is a set***.

(ii) Clearly, the members of collection are the novels written by Munshi Prem Chand.

$\therefore$ This collection is well-difined and hence, ***it is a set***.

S23. A is the set of triangles in which no triangle is equilateral. Hence A' is the set of all equilateral triangles.

S24. Since, $e, i, o, u \in A$ but $\notin B$. So $A \not\subset B$ and conversly $b, c, d \in B$ but $\notin A$. so $B \not\subset A$.

S25. (i) $\phi \subset B$ as ϕ is a subset of every set.

(ii) $A \not\subset B$ as $3 \in A$ and $3 \notin B$

(iii) $A \subset C$ as $1, 3 \in A$ also belongs to C.

(iv) $B \subset C$ as each element of B is also an element of C.

S26. (i) We have, X = {A, L, L, O, Y}, B = {L, O, Y, A, L}. Then X and B are equal sets as repetition of elements in a set do not change a set. Thus,

$$X = \{A, L, O, Y\} = B$$

(ii) $A = \{-2, -1, 0, 1, 2\}$, $B = \{1, 2\}$. Since $0 \in A$ and $0 \notin B$, A and B are not equal sets.

S27. We see that each member in the given set has the numerator one less than the denominator. Also, the numerator begin from 1 and do not exceed 6. Hence, in the set-builder form the given set is

$$\left\{x : x = \frac{n}{n+1}, \text{ where } n \text{ is a natural number and } 1 \le n \le 6\right\}.$$

S28. We may write the set A as

$$A = \{x : x \text{ is the square of a natural number}\}$$

Alternatively, we can write

$$A = \{x : x = n^2, \text{ where } n \in \mathbb{N}\}.$$

S29. The required numbers are 1, 2, 3, 4, 5, 6. So, the given set in the roster form is {1, 2, 3, 4, 5, 6}.

S30. The given equation can be written as

$$(x - 1)(x + 2) = 0 \quad i.e., \quad x = 1, -2$$

Therefore, the solution set of the given equation can be written in roster form as {1, –2}.

S31. (i) We can definitely say that the members of this collection are 2, 4, 6, ...

$\therefore$ This collection is well-defined and hence, it is a set.

(ii) Clearly, the members of the collection are the different questions of this chapter.

So, it is well-defined and hence, ***it is a set***.

(iii) The term 'most dangerous' is a vague term. An animal may be most dangerous to one person and may not be so to the other. It is not a set.

S32. Set A can be written in roaster form as

$$A = \{1, 4, 9\}$$

Hence proper subsets of A is {1}, {4}, {9}, {1, 4}, {1, 9}, {4, 9}, and ϕ.

S33. Set A can be written in Roaster form as

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

Obviously set A has five elements. Hence total no. of subsets of set A is $2^5 = 32$

S34. $A = \{x : x \in Z, x^2 = 1\}$,

$$x^2 = 1 \quad \Rightarrow \quad x^2 - 1 = 0 \quad \Rightarrow \quad (x - 1)(x + 1) = 0$$

$$\Rightarrow \quad x = -1, 1$$

Hence, solution set for A is $\{-1, 1\}$.

$$B = \{x : x \in N, x^2 = 1\}$$

$$x^2 = 1 \quad \Rightarrow \quad x^2 - 1 = 0 \quad \Rightarrow \quad (x - 1)(x + 1) = 0$$

$$\Rightarrow \quad x = -1, +1 \quad \text{but} \quad -1 \notin N$$

Hence solution set for B is $\{1\}$.

Clearly from above discussion

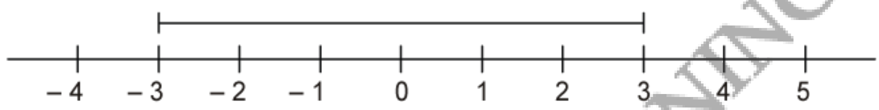
$$B \subseteq A \text{ but } A \not\subseteq B.$$

S35. $\{x : x \in R, -3 \le x \le 3\}$

Hence, length of interval is

$$= 3 - (-3) = 6$$

On the real number line it can be represented as



$\Rightarrow \quad [-3, 3]$

S36. If inequalities are of the form $\ge$ or $\le$ then use the symbol "[ ]" for closed interval and then find the length of the interval which is equal to the difference of its extreme values.

$\therefore \quad \{x : x \in R, -12 < x < -10\} = \{-12, -10\}$ and length of the interval

$$= -10 - (-12) = 2$$

On the real line set $[-12, -10]$ may be represented as shown in the given figure.

The coloured portion on the number line is the required set.

S37. The collection of all subsets of set A is called power set of A and is denoted by $P(A)$.

Hence power set of $A = \{0, 1, 2\}$ is $\{\{0\}, \{1\}, \{2\}, \{0, 1\}, \{0, 2\}, \{1, 2\}, \{0, 1, 2\}, \{\phi\}\}$.

S38. $\phi \subseteq A$ empty set is a subset of each set.

$$\because \quad A \subseteq \phi \qquad \text{... (i)}$$

$$\phi \subseteq A \qquad \text{... (ii)}$$

From eq. (i) and (ii), we get

$A = \phi$

S39. Clearly it has 16 subsets.

$\Rightarrow$ 16 subset which can be written as follows

{1}, {2}, {3}, {4}, {1, 2}, {1, 3}, {1, 4}, {2, 3}, {2 ,4}, {3, 4}, {1, 2, 3}, {1, 2, 4}, {2, 3, 4}, {1, 3, 4}, {1, 2, 3, 4}, ϕ.

Analyse the writing pattern for subset only.

S40. (a) The subset of $\{a, e, i\}$ are $\{a\}, \{e\}, \{a, e\}, \{a, i\}, \{a, e, i\}, \{\phi\}, \{i\}, \{e, i\}$.

(b) The subset of $\{\phi\}$ is ϕ.

S41. (a) Since null set is a subset of every set

$\therefore \quad \phi \subset B$

(b) Given $A = \{1, 2\}$ and $B = \{1, 4, 8\}$

Since element $\quad 2 \notin B$.

$\therefore \quad A \not\subset B$.

S42. Total no. of subsets of A is $2^5 = 32$ and it can be written as

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

S43. Here A contains two elements namely 1 and {2, 3}.

Let $\quad \{2, 3\} = B$ then $A = \{1, B\}$

$\therefore \quad P(A) = \{\phi, \{1\}, \{B\}, \{1, B\}\}$.

$\Rightarrow \quad P(A) = \{\phi, \{1\}, \{\{2, 3\}\}, \{2, 3\}\}$

S44. Since set A can be written in Roaster form as

$$A = \{4, 5, 6, 7, 8, 9\}.$$

Total no. of subsets of A is 2^6.

Hence total no. of elements in $P(A) = 2^6$.

Hence $\quad n(P(A)) = 2^6$

S45. We have $\quad P(\phi) = \{\phi\}$.

$\therefore \quad P(P(\phi)) = \{\phi, \{\phi\}\}$

$\Rightarrow \quad [P(P(\phi))] = \{\phi, \{\phi\}, \{\{\phi\}\}, \{\phi, \{\phi\}\}\}$

Hence number of element in $n[P(P(\phi))] = 4$

S46. (a) $\{x : x \in R, -6 < x < 0\}$ (b) $\{x : x \in R, 3 \le x \le 21\}$

(c) $\{x : x \in R, -23 < x \le 8\}$ (d) $\{x : x \in R, 0 < x < 1\}$

S47. $x^3 = 1 \Rightarrow x^3 - 1 = 0$

$\because$ $(x - 1)(x^2 + x + 1) = 0$

Since $(x^2 + x + 1)$ is always positive.

Hence $x - 1 = 0 \Rightarrow x = 1$

Hence real solution set for S is {1}.

Hence all possible subsets of S is {1}, ϕ.

S48. $x^3 - 6x^2 + 11x - 6 = 0$

$= x^2(x - 2) - 4x(x - 2) + 3(x - 2) = 0$

$\Rightarrow (x^2 - 4x + 3)(x - 2) = 0$

$\Rightarrow (x - 1)(x - 3)(x - 2) = 0$

$\Rightarrow x = 1, 2, 3$

Hence, set S can be written in Roaster form as

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

Hence all possible subsets of S are {1}, {2},{3},{1, 2}, {1, 3}, {2, 3}, {1, 2, 3}, ϕ.

S49. (i) Given set = {2}. Hence, it is finite. (ii) Given set = ϕ, Hence, it is finite.

(iii) The given set is the set of all prime numbers and since set of prime numbers is infinite. Hence the given set is infinite.

(iv) Since there are infinite number of odd numbers, hence, the given set is infinite.

S50. $x^4 - 1 = 0 \Rightarrow (x^2 - 1)(x^2 + 1) = 0$

Since $(x^2 + 1)$ is non negative non zero expression.

Hence $x^2 - 1 = 0 \Rightarrow (x - 1)(x + 1) = 0$

$\Rightarrow x = 1, -1$

Hence, solution of set for A is {1, –1}.

Hence, all possible subset is {1}, {–1}, ϕ, {1, – 1}.

S51. Since $x^2 - 5x + 6 = 0$

$\Rightarrow x^2 - 2x - 3x + 6 = 0$

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

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

$\Rightarrow x = 2, 3$

Solution set of A is {2, 3}.

Hence possible subsets of A is {2}, {3}, {2, 3}, {ϕ}.

S52. Let $A = B$, then by definition of equal sets, every element of A is in B and every element of B is in A.

$\therefore$ $A \subseteq B$ and $B \subseteq A$

Again, let $A \subseteq B$ and $B \subseteq A$. Then by definition of subset, it follows that every element of A is in B and every element of B is in A.

Consequently $A = B$.

Thus,

$$(A \subseteq B \text{ and } B \subseteq A) \Rightarrow A = B$$

Hence, $A = B \Leftrightarrow (A \subseteq B \text{ and } B \subseteq A)$

S53. Since $0 \in A$ and 0 does not belong to any of the sets B, C, D and E in follows that, $A \neq B$, $A \neq C$, $A \neq D$, $A \neq E$.

Since $B = \phi$ but none of the other sets are empty. Therefore, $B \neq C$, $B \neq D$ and $B \neq E$. Also, $C = \{5\}$ but $-5 \in D$, hence $C \neq D$.

Since, $E = \{5\}$, $C = E$. Further, $D = \{-5, 5\}$ and $E = \{5\}$, we find that, $D \neq E$. Thus, the only pair of equal sets is C and E.

S54. Given $A = \{3, \{4, 5\}, 6\}$

Here 3, {4, 5}, 6 all are elements of A.

(a) $\{4, 5\} \subset A$, which is not true. Since element of any set is not a subset of any set and here {4, 5} is an element of A.

(b) $\{4, 5\} \in A$, is true statement.

(c) It is always true that of $\phi \subset A$.

(d) {3, 6} makes a set , so it is subset of A.

S55. Let x be an arbitary element of A. Then, there exists a subset, say X, of set A such that $x \in X$.

Now, $X \subset A \Rightarrow X \in P(A)$

$\Rightarrow$ $X \in P(B)$ [P (A) = P (B)]

$\Rightarrow$ $X \subset B$

$\Rightarrow$ $x \in B$ [$x \in X$ and $X \subset B \Rightarrow x \in B$]

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

Hence, $X \subset B$ ... (i)

Now, let y be an arbitary element of B. Then, there exists a subset, say Y, of set B such that $y \in Y$.

Now, $Y \subset B \Rightarrow Y \in P(B)$

$\Rightarrow$ $Y \in P(A)$ [$P(A) = P(B)$]

$\Rightarrow$ $Y \subset A \Rightarrow Y \in A$

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

Hence, $B \subset A$ .. (ii)

From Eq. (i) and (ii), we get $A = B$. **Hence proved**.

Date: 9/10/2021

Q1. Let X = {Ram, Geeta, Akbar} be the set of students of Class XI, who are in school hockey team. Let Y = {Geeta, David, Asok} be the set of students from Class XI who are in the school football team. Find (i) $X \cup Y$, (ii) $X \cap Y$ and interpret the set.

Q2. Let $A = \{a, e, i, o, u\}$ and $B = \{a, i, u\}$. Show that $A \cup B = A$.

Q3. Let $A = \{2, 4, 6, 8\}$ and $B = \{6, 8, 10, 12\}$. Find (i) $A \cup B$, (ii) $A \cap B$.

Q4. Let $A = \{1, 2\}$, $B = \{3, 6\}$, check whether A and B are disjoint sets or not.

Q5. Let $U = \{1, 2, 3, 4, 5, 6, 7\}$ and $A = \{3, 4, 5\}$, find compliment of set A.

Q6. Let S = Set of points inside the square, T = set of points inside the triangle and C = Set of points inside the circle. If the triangle and circle intersect each other and are contained in a square then prove that

$S \cup T \cup C = S$ by venn diagram

Q7. Let $A \subset B \subset U$. Exhibit it in venn diagram.

Q8. Let U be the universal set given that $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$ and $A = \{1, 3, 4, 5\}$, $B = \{2, 4, 5, 6\}$. Represent $(A \cap B)$ in venn diagram.

Q9. Let $A = \{1, 2\}$ and $B = \{2, 4, 5\}$, then find $(A - B) \cup A$.

Q10. Let $A = \{1, 2\}$ and $B = \{2, 3\}$, then find $(A - B) \cup (B - A)$.

Q11. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$, $C = \{11, 13, 15\}$, find $A \cap B$, and $B \cap C$.

Q12. If $A = \{1, 3, 5, 7\}$, $B = \{3, 5, 7\}$ and $C = \{0, 1, 3, 5\}$, find $A \cup B$, $B \cup C$.

Q13. Let $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{2, 4, 6, 8\}$. Find $A - B$ and $B - A$.

Q14. Let $V = \{a, e, i, o, u\}$ and $B = \{a, i, k, u\}$. Find $V - B$ and $B - V$.

Q15. Taking the set of natural numbers the universal set, write down the complements of the following sets.

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

Q16. Taking the set of natural numbers the universal set, write down the complements of the following sets.

(i) $\{x : x$ is a positive multiple of 3$\}$ (ii) $\{x : x$ is a prime number$\}$

Q17. Taking the set of natural numbers the universal set, write down the complements of the following sets.

(i) $\{x : x$ is a natural number divisible by 3 and 5$\}$ (ii) $\{x : x$ is a perfect square$\}$

Q18. Show that $A \cap B = A \cap C$ need not imply $B = C$.

Q19. Using properties of sets, show that: (i) $A \cup (A \cap B) = A$, (ii) $A \cap (A \cup B) = A$.

Q20. Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $B = \{2, 3, 5, 7\}$. Find $A \cap B$ and hence show that $A \cap B = B$.

Q21. Is it true that for any sets A and B, $P(A) \cup P(B) = P(A \cup B)$? Justify your answer.

Q22. Find sets A, B and C such that $A \cap B$, $B \cap C$ and $A \cap C$ are non-empty sets and $A \cap B \cap C = \phi$.

Q23. If $A = \{1, 2\}$, $B = \{2, 3\}$ and $C = \{3, 4\}$, find $(A \cap B) \cup C$.

Q24. If $A = \{1, 2\}$, $B = \{2, 3\}$ and $C = \{3, 4\}$, find $\{A \cup B\} \cap C$.

Q25. Let $A = \{a, b, c\}$, $U = \{a, b, c, d\}$, prove that $(A')' = A$.

Q26. Find $(A - B)$ and $(B - A)$ when $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{2, 4, 6, 8, 10\}$

Q27. If $A \cap B' = \phi$ then show that $A = A \cap B$ and hence show that $A \subseteq B$.

Q28. Give an example of two sets A and B such that $P(A) \cup P(B) \neq P(A \cup B)$.

Q29. Let $A = \{x : x^2 - 5x + 6 = 0, x \in R\}$ and $B = \{x : x^2 - 3x + 2 = 0, x \in R\}$, check whether A and B are disjoint sets or not.

Q30. If $A = \{4, 5, 7, 8, 10\}$, $B = \{4, 5, 9\}$ and $C = \{1, 4, 6, 9\}$ then verify that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

Q31. If A and B are two none empty sets then using properties of sets prove that

(a) $A \cup (A \cap B) = A$ (b) $A \cap (A \cup B) = A$.

Q32. If $A_i = [0, i]$, where $i \in z$. The set of integers. Find

(a) $A_1 \cup A_2$ (ii) $A_3 \cap A_4$ (iii) $\bigcup_{i=5}^{10} A_i$

Q33. Verify $(A \cap B)' = A' \cup B'$, where $A = \{3, 4, 5, 6\}$ and $B = \{3, 6, 7, 8\}$ are subset of $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$.

Q34. Let $U = \{x : x^3 - 6x^2 + 11x - 6 = 0\}$ and $A = \{x : x^2 - 5x + 6 = 0\}$, find compliment of A.

Q35. If $U = \{a, b, c, d, e, f, g, h\}$, then find the compliment of the following sets

(a) $A = \{a, b, c\}$ (b) $B = \{d, e, f, g\}$ (c) $C = \{a, c, e, g\}$ (d) $D = \{f, g, h\}$

Q36. Find $A \Delta B$ if

(a) $A = \{1, 3, 4\}$ and $B = \{2, 5, 9, 11\}$ (b) $A = \{1, 3, 6, 11, 12\}$ and $B = \{1, 6\}$.

Q37. Taking the set of natural numbers the universal set, write down the complements of the following sets.

(i) $\{x : x$ is a perfect cube$\}$ (ii) $\{x : x + 5 = 8\}$ (iii) $\{x : 2x + 5 = 9\}$

(iv) $\{x : x \geq 7\}$ (v) $\{x : x \in N$ and $2x + 1 > 10\}$

Q38. If $U = \{a, b, c, d, e, f, g, h\}$, find the complements of the following sets:

(i) $A = \{a, b, c\}$ (ii) $B = \{d, e, f, g\}$ (iii) $C = \{a, c, e, g\}$ (iv) $D = \{f, g, h, a\}$

Q39. For any sets A and B, show that $P(A \cap B) = P(A) \cap P(B)$.

Q40. Let $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 3\}$ and $B = \{3, 4, 5\}$. Find A', B', $A' \cap B'$, $A \cup B$ and hence show that $(A \cup B)' = A' \cap B'$.

Q41. For any set A and B, show that

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

Q42. Distinguish among ϕ, $\{\phi\}$, $\{0\}$ and 0.

Q43. Show that for any sets A and B, $A = (A \cap B) \cup (A - B)$ and $A \cup (B - A) = (A \cup B)$.

Q44. Show that the following four conditions are equivalent:

(i) $A \subset B$ (ii) $A - B = \phi$ (iii) $A \cup B = B$ (iv) $A \cap B = A$

Q45. Let A, B and C be the sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$.

Q46. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$. Verify that

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

Q47. Draw appropriate Venn diagram for each of the following:

(i) $(A \cup B)'$ (ii) $A' \cap B'$ (iii) $(A \cap B)'$ (iv) $A' \cup B'$

Q48. Let A and B be sets. If $A \cap X = B \cap X = \phi$ and $A \cup X = B \cup X$ for some set X, show that $A = B$.

Q49. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$. Find

(i) A', (ii) B', (iii) $(A \cup C)'$, (iv) $(A \cup B)'$, (v) $(A')'$, (vi) $(B - C)'$.

Date: 9/10/2021

S1. (i) We have, $X \cup Y$ = {Ram, Geeta, Akbar, David, Asok}. This is the set of students from Class XI who are in the hockey team or the football team or both.

(ii) We see that element 'Geeta' is the only element common to both. Hence, $X \cap Y$ = {Geeta}.

S2. We have, $A \cup B = \{a, e, i, o, u\} = A$.

This example illustrates that union of sets A and its subset B is the set A itself, *i.e.*, if $B \subset A$, then $A \cup B = A$.

S3. (i) We have, $A \cup B = \{2, 4, 6, 8, 10, 12\}$

Note that the common elements 6 and 8 have been taken only once while writting $A \cup B$.

(ii) We see that 6, 8 are the only elements which are comon to both A and B. Hence, $A \cap B = \{6, 8\}$.

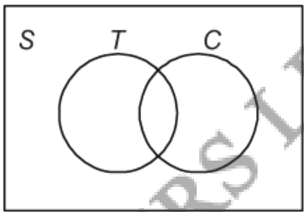
S4. Since two sets are said to be disjoint if $A \cap B = \phi$.

In this problem $A \cap B = \phi$. So A and B are disjoint sets.

S5. Here, $A' = \{1, 2, 6, 7\}$.

A' is called compliment of set A.

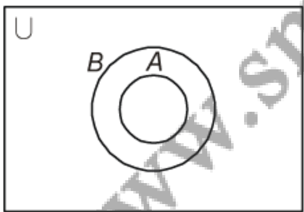
S6. According to given condition the venn diagram is given below:



It is clear from the venn diagram that

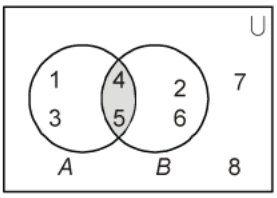
$$S \cup T \cup C = S$$

S7. It can be represented as follows:



$$A \subset B \subset U$$

S8. Clearly $A \cap B = \{4, 5\}$ and it can be represented in venn diagram as



S9. Clearly, $(A - B) = \{1\}$

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

S10. Now, $(A - B) = \{1\}$

$(B - A) = \{3\}$

Hence, $(A - B) \cup (B - A) = \{1, 3\}$.

S11. We have, $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$ and $C = \{11, 13, 15\}$.

Hence,

(a) $A \cap B = \{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13\} = \{7, 9, 11\}$.

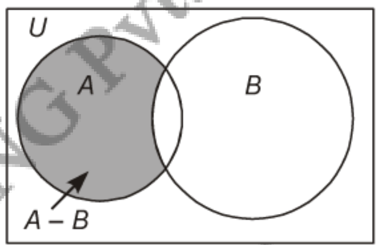
(b) $B \cap C = \{11, 13\}$

S12. $A \cup B = \{1, 3, 5, 7\}$, $B \cup C = \{0, 1, 3, 5, 7\}$.

S13. We have, $A - B = \{1, 3, 5\}$, since the elements 1, 3, 5 belong to A but not to B and $B - A = \{8\}$, since the element 8 belongs to B and to A.

We note that $A - B \neq B - A$.

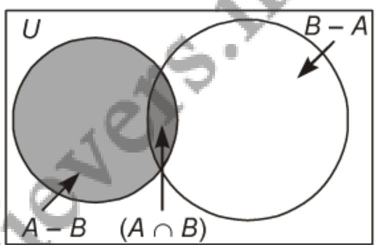
S14. We have, $V - B = \{e, o\}$, since the elements e, o belong to V but not to B and $B - V = \{k\}$, since the element k belongs to B but not to V.



We note that $V - B \neq B - V$. Using the set-builder notation, we can rewrite the definition of difference as

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

The difference of two sets A and B can be represented by Venn diagram as shown in figure.



The shaded portion represents the difference of the two sets A and B.

The sets $A - B$, $A \cap B$ and $B - A$ are mutually disjoint sets, *i.e.*, the intersection of any of these two sets is the null set as shown in figure.

S15. (i) $\{x : x$ is an odd natural number$\}$ (ii) $\{x : x$ is an even natural number$\}$

S16. (i) $\{x : x \in N$ and x is not a multiple of 3$\}$ (ii) $\{x : x$ is a positive composite number and $x = 1\}$

S17. (i) $\{x : x \in N$ and x is neither a multiple of 3 nor of 5$\}$

(ii) $\{x : x \in N$ and x is not a perfect square$\}$

S18. With the help of an example, we may try to establish it.

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

Now, $A \cap B = \{1, 2\} \cap \{1, 3\} = \{1\}$

and $A \cap C = \{1, 2\} \cap \{1, 4\} = \{1\}$

Hence, $A \cap B = A \cap C$. But $B \neq C$.

S19. (i) We have, $A \cup (A \cap B) = (A \cup A) \cap (A \cup B)$ [$\because$ U is distributive over $\cap$]

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

$= A.$ [$\because$ $A \subset A \cup B$]

(ii) We have, $A \cap (A \cup B) = (A \cap A) \cup (A \cap B)$ [$\because$ U is distributive over $\cap$]

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

$= A.$ [$\because$ $A \cap B \subset B$]

S20. We have, $A \cap B = \{2, 3, 5, 7\} = B$. We note that $B \subset A$ and that $A \cap B = B$.

S21. **False.** Let, $A = \{a\}$, $B = \{b\}$ and $A \cup B = \{a, b\}$

Hence, $P(A) = \{\phi, \{a\}\}$, $P(B) = \{\phi, \{b\}\}$

and $P(A \cup B) = \{\phi, \{a\}, \{b\}, \{a, b\}\}$ ... (i)

and $P(A) \cup P(B) = \{\phi, \{a\}, \{b\}\}$ ... (ii)

From (i) (ii), we get

$$P(A \cup B) \neq P(A) \cup P(B).$$

S22. We may take $A = \{1, 2\}$, $B = \{1, 3\}$, and $C = \{2, 3\}$

Clearly, $A \cap B = \{1\}$, $B \cap C = \{3\}$ and $A \cap C = \{2\}$

i.e., $A \cap B$, $B \cap C$ and $A \cap C$ are non-empty sets and $A \cap B \cap C = (A \cap B) \cap C = \{1\} \cap \{2, 3\} = \phi$.

S23. We have, $A = \{1, 2\}$, $B = \{2, 3\}$ and $C = \{3, 4\}$

$\therefore$ $(A \cap B) = \{2\}$.

$\therefore$ $(A \cap B) \cup C = \{2\} \cup \{3, 4\} = \{2, 3, 4\}$

S24. We have, $A = \{1, 2\}$, $B = \{2, 3\}$ and $C = \{3, 4\}$.

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

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

S25. We have, $A = \{a, b, c\}$ ... (i)

$U = \{a, b, c, d\}$

$(A') = \{d\}$

$(A')' = \{a, b, c\}$ ... (ii)

From Eq. (i) and (ii),

$(A')' = \text{A}$ **Proved**.

S26. Now, $(A - B) = \{1, 2, 3, 4, 5, 6\} - \{2, 4, 6, 8, 10\} = \{1, 3, 5\}$

$(B - A) = \{2, 4, 6, 8, 10\} - \{1, 2, 3, 4, 5, 6\} = \{8, 10\}$.

S27. Let $A \cap B' = \phi$ be given than $A = A \cap U$. Where U is universal set.

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

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

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

But $A \cap B = A$ means $A \subseteq B$.

S28. Let $A = \{1\}$ and $B = \{2\}$ then

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

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

Clearly, $\quad P(A) \cup P(B) \neq P(A \cup B)$

S29.
$$x^2 - 5x + 6 = 0$$
$$(x - 2)\,(x - 3) = 0 \quad \Rightarrow \quad x = 2, 3$$

Solution set for A is $\{2, 3\}$.

Similarly,

$$x^2 - 3x + 2 = 0$$
$$(x - 2)\,(x - 1) = 0$$
$$\Rightarrow \quad x = (1, 2)$$

Solution set for B is $\{2, 3\}$

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

Hence A and B are not disjoint sets.

S30.
$$(B \cup C) = \{1, 4, 5, 6, 9\}$$
$$\therefore \quad A \cap (B \cup C) = \{4, 5\} \quad \text{... (i)}$$
$$A \cap B = \{4, 5\}$$
$$A \cap C = \{4\}$$
$$\therefore \quad (A \cap B) \cup (A \cap C) = \{4, 5\} \quad \text{... (ii)}$$

From (i) and (ii)

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

S31. Let U be the universal set than

(a) $\quad A \cup (A \cap B) = (A \cap U) \cup (A \cap B) \quad \because \quad A = (A \cap U)$

$$= A \cap (U \cup B) \text{ by distributive law}$$
$$= A \cap U = A$$

(b) $\quad A \cap (A \cup B) = (A \cup \phi) \cap (A \cup B) \quad \because \quad A = A \cap \phi$

$$= A \cup (\phi \cap B)$$
$$= A$$
$$\therefore \quad A \cap (A \cup B) = \text{A}$$

S32. (a) $A_1 \cup A_2$ consists of all real numbers in the interval [0,1] and [0, 2] then

$$A_1 \cup A_2 = [0, 2] = A_2$$

(b) $A_3 \cap A_4$ consists of all real numbers which lie in both the interval [0, 3] and [0, 4]

$$A_3 \cap A_4 = [0, 3] = A_3$$

(c) $\overset{10}{\underset{i=5}{U}} A_i$ denotes the union of the sets $A_5, A_6, A_7, A_8, A_9, A_{10}$. The union of [0, 5], [0, 6], [0, 7], [0, 8], [0, 9], [0, 10].

So, $$\overset{10}{\underset{i=5}{U}} A_i = [0, 10] = A_{10}$$

S33. We have $A = \{3, 4, 5, 6\}$, $B = \{3, 6, 7, 8\}$ and $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$

$\therefore$ $$(A \cap B) = \{3, 6\}$$

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

$$= \{1, 2, 4, 5, 7, 8\} \quad \text{... (i)}$$

Also, $$A' = U - A = \{1, 2, 7, 8\}$$

$$B' = U - B = \{1, 2, 4, 5\} \quad \text{... (ii)}$$

$\therefore$ $$A' \cup B' = \{1, 2, 4, 5, 7, 8\}$$

From (i) and (ii), we get

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

S34. $$x^3 - 6x^2 + 11x - 6 = 0$$

$$x^2(x - 2) - 4x(x - 2) + 3(x - 2) = 0$$

$$(x^2 - 4x + 3)(x - 2) = 0$$

$\Rightarrow$ $$(x - 3)(x - 1)(x - 2) = 0$$

$$x = 1, 2, 3$$

Hence solution set for U is {1, 2, 3}

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

$\Rightarrow$ $$(x - 2)(x - 3) = 0 \quad \Rightarrow \; x = 2, 3$$

Hence solution set for A is {2, 3}.

Hence compliment of A is {1}.

$$A' = \{1\}.$$

S35. (a) $$A' = U - A$$

$$= (d, e, f, g, h)$$

(b) $$B' = U - B$$

$= \{a, b, c, h\}$

(c) Compliment of C is C'.

$C' = U - C = \{b, d, f, h\}$

(d) Compliment of D is D'

$D' = \{a, b, c, d, e,\}$

S36. (a) $(A - B) = \{1, 3, 4\}$

$B - A = \{2, 5, 9, 11\}$

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

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

(b) $(A - B) = \{3, 11, 12\}$

$(B - A) = \phi$

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

$= \{3, 11, 12\}$

S37. (i) $\{x : x \in N$ and is not a perfect cube$\}$.

(ii) $\{x : x \in N$ and $x \neq 3\}$ $\{x + 5 = 8 \Rightarrow x = 8 - 5 = 3\}$.

(iii) $\{x : x \in N$ and $x \neq 2\}$ $\{2x + 5 = 9 \Rightarrow 2x = 9 - 5 \Rightarrow 2x = 4 \Rightarrow x = 2\}$.

(iv) $\{x : x \in N$ and $x < 7\} = \{1, 2, 3, 4, 5, 6\}$.

(v) $\{x : x \in N$ and $x \leq 9/2\}$ $\{2x + 1 > 10 \Rightarrow 2x > 10 - 1 \Rightarrow 2x > 9 \Rightarrow x > 9/2\}$.

S38. Here, $U = \{a, b, c, d, e, f, g, h\}$

(i) $A' = U - A = \{a, b, c, d, e, f, g, h\} - \{a, b, c\} = \{d, e, g, f, h\}$

(ii) $B' = U - B = \{a, b, c, d, e, f, g, h\} - \{d, e, f, g\} = \{a, b, c, h\}$

(iii) $C' = U - C = \{a, b, c, d, e, f, g, h\} - \{a, c, e, g\} = \{b, d, f, h\}$

(iv) $D' = U - D = \{a, b, c, d, e, f, g, h\} - \{f, g, h, a\} = \{b, c, d, e\}$

S39. Let $X \in P(A \cap B)$. Then $X \subset A \cap B$. So, $X \subset A$ and $X \subset B$. Therefore, $X \in P(A)$ and $X \in P(B)$ which implies $X \in P(A) \cap P(B)$. This gives $P(A \cap B) \subset P(A) \cap P(B)$. Let $Y \in P(A) \cap P(B)$. Then $Y \in P(A)$ and $Y \in P(B)$. So $Y \subset A$ and $Y \subset B$. Therefore $Y \in A \cap B$, which implies $Y \in P(A \cap B)$.

This gives $P(A) \cap P(B) \subset P(A \cap B)$.

Hence, $P(A \cap B) = P(A) \cap P(B)$.

S40. Clearly, $A' = \{1, 4, 5, 6\}$, $B' = \{1, 2, 6\}$.

Hence, $A' \cap B' = \{1, 6\}$

Also, $A \cup B = \{2, 3, 4, 5\}$,

so that $(A \cup B)' = \{1, 6\}$

$(A \cup B)' = \{1, 6\} = A' \cap B'$

It can be shown that the above result is true in general. If A and B are any two subsets of the universal set U, then

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

Similarly, $$(A \cap B)' = A' \cup B'.$$

S41. (a)
$$\text{L.H.S.} = (A \cap B) \cup (A - B)$$
$$= (A \cap B) \cup (A \cap B')$$
$$= A \cap (B \cup B')$$
$$= A \cap U = A = \text{R.H.S.}$$

(b)
$$\text{L.H.S.} = A \cup (B - A)$$
$$= A \cup (B \cap A')$$
$$= (A \cup B) \cup (A \cup A')$$
$$= (A \cup B) \cap U$$
$$= (A \cup B) = \text{R.H.S.}$$

S42. (a) ϕ is a set containing no element.

(b) $\{\phi\}$ is an singleton set containing one element ϕ.

(c) $\{0\}$ is also a singleton set containing the element 0.

(d) 0 is simply a number, it is neither a set, nor a element of a set.

S43. (i) $(A \cap B) \cup (A - B) = (A \cap B) \cup (A \cap B')$ [$A - B = A \cap B'$]

$= A \cap (B \cup B')$ [Distributive Law]

$= A \cap X$, where $X = (B \cup B')$ is universal set.

$= A$. **Hence proved**.

(ii) $A \cup (B - A) = A \cup (B \cap A')$ [$B - A = B \cap A'$]

$= (A \cup B) \cap (A \cup A')$ [D.L.]

$= (A \cup B) \cap X$, where $X = (A \cup A')$ is universal set.

$= (A \cup B)$. **Hence proved**.

S44. (i) $\Leftrightarrow$ (ii), As $A \subset B = B \Leftrightarrow$ All the elements of A are in B.

$\Leftrightarrow$ $A - B = \phi$

(ii) $\Leftrightarrow$ (iii), $A - B = \phi \Leftrightarrow$ All elements of A are in B.

$\Leftrightarrow$ $A \cup B = B$

(iii) $\Leftrightarrow$ (iv), As $A \cup B = B \Leftrightarrow$ All the elements of A are in B.

$\Leftrightarrow$ All the elements of A are common in A and B.

$\Leftrightarrow$ $A \cap B = A$

Thus, all the four given conditions are equivalent.

S45. We have $A \cup B = A \cup C$

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

$\Rightarrow \quad (A \cap C) \cup (B \cap C) = C \qquad [\because (A \cup C) \cap C = C]$

$\Rightarrow \quad (A \cap B) \cup (B \cap C) = C \qquad [\because A \cap C = A \cap B] \quad \ldots \text{(i)}$

Again, $A \cup B = A \cup C$

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

$\Rightarrow \quad B = (A \cap B) \cup (C \cap B) \qquad [\because (A \cup B) \cap B = B]$

$\Rightarrow \quad B = (A \cap B) \cup (B \cap C) \quad \ldots \text{(ii)}$

From (i) and (ii), we get $B = C$. **Hence proved**.

S46. (i) $A \cup B = \{2, 4, 6, 8\} \cup \{2, 3, 5, 7\}$

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

L.H.S. $= (A \cup B)' = U - (A \cup B)$

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

Now, $A' = U - A$

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

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

and $B' = U - B$

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

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

R.H.S. $= A' \cap B'$

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

L.H.S. = R.H.S.

Hence, $(A \cup B)' = A' \cap B'$ is verified.

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

L.H.S. $= (A \cap B)' = U - (A \cap B)$

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

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

R.H.S. $= A' \cup B'$

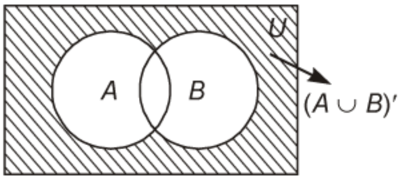
$= \{1, 3, 5, 7, 9\} \cup \{1, 4, 6, 8, 9\}$

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

L.H.S. = R.H.S.

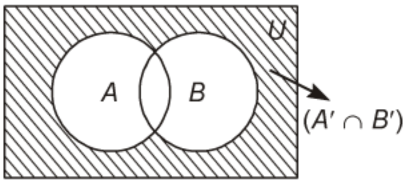
Hence, $(A \cap B)' = A' \cup B'$ is verified.

S47. (i) $(A \cup B)'$



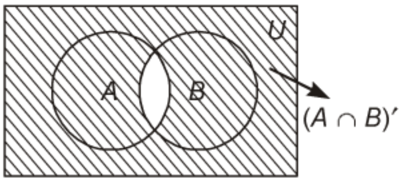
The shaded region indicates $(A \cup B)'$

(ii) $A' \cap B'$



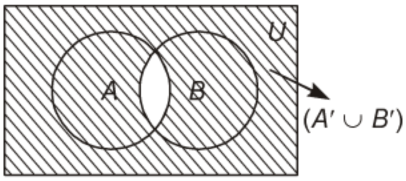
The shaded region indicates $(A' \cap B')$

(iii) $(A \cap B)'$



The shaded region indicates $(A \cap B)'$

(iv) $A' \cup B'$



The shaded region indicates $(A' \cup B')$

S48. We have, $A \cup X = B \cup X$ for some set X.

$\Rightarrow \quad A \cap (A \cup X) = A \cap (B \cup X)$

$\Rightarrow \quad A = (A \cap B) \cup (A \cap X) \quad [A \cap (A \cup X) = A]$

$= (A \cap B) \cup \phi \quad [A \cap X) = \phi \text{ (Given)}]$

$= A \cap B \Rightarrow A \subset B \quad \ldots \text{(i)}$

Again, $A \cup X = B \cup X$

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

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

$(B \cap A) \cup \phi = B \quad [B \cap X = \phi \text{ (Given)}]$

$B \cap A = B$

$B \cap A = B \Rightarrow B \subset A \quad \ldots \text{(ii)}$

From (i) and (ii), we get $A = B$. **Hence proved**.

S49. Here, $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$

(i) $A' = U - A = \{5, 6, 7, 8, 9\}$

(ii) $B' = U - B = \{1, 3, 5, 7, 9\}$

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

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

Hence, $(A \cup C)' = U - (A \cup C) = \{7, 8, 9\}$

(iv) $A \cup B = \{1, 2, 3, 4\} \cup \{2, 4, 6, 8\}$

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

Hence, $(A \cup B)' = U - (A \cup B) = \{5, 7, 9\}$

(v) $A' = U - A = \{5, 6, 7, 8, 9\}$

Hence, $(A')' = U - A' = \{1, 2, 3, 4\}$

(vi) $B - C = \{2, 4, 6, 8\} - \{3, 4, 5, 6\} = \{2, 8\}$

Hence, $(B - C)' = U - (B - C) = \{1, 3, 4, 5, 6, 7, 9\}$

Date: 9/10/2021

Q1. If A and B are two sets such that $n(A) = 27$, $n(B) = 35$ and $n(A \cup B) = 50$, find $n(A \cap B)$.

Q2. If X and Y are two sets such that $n(X) = 17$, $n(Y) = 23$ and $n(X \cup Y) = 38$ then find $n(X \cap Y)$.

Q3. If X and Y are two sets such that $n(X) + n(Y) = 20$ and $n(X \cap Y) = 10$, find $n(X \cup Y)$.

Q4. If X and Y are two sets such that $(X \cup Y)$ has 18 elements, X has 8 elements and Y has 15 elements. Then how many elements does $(X \cap Y)$ have?

Q5. If $n(A) = 4$, $n(B) = 5$, $n(U) = 7$ and $n(A \cap B) = 2$ then find the value of $n(A \cup B)'$.

Q6. Out of 500 car owners investigated, 400 owned car A and 200 owned car B. 50 owned both A and B cars. Is this data correct?

Q7. If S and T are two sets such that S has 21 elements, T has 32 elements, and $S \cap T$ has 11 elements, how many elements does $S \cup T$ have?

Q8. If X and Y are two sets such that X has 40 elements, $X \cup Y$ has 60 elements and $X \cap Y$ has 10 elements, how many elements does Y have?

Q9. If X and Y are two sets such that $X \cup Y$ has 50 elements, X has 28 elements and Y has 32 elements, how many elements does $X \cap Y$ have?

Q10. A survey shows that 73% of Indians like apples whereas 65% like oranges. What percentage of Indians like both apples and oranges?

Q11. A computer company must hire 20 programmers to handle system programming jobs, and 30 programmers for application.
Programming of those hired 5 are expected to perform jobs of both type. How many programmers must be hired?

Q12. In an examination 56% of candidates failed in English and 48% failed in science if 18% failed in both English and science find the percentage of those who passed in both the subjects.

Q13. For sets A, B and C prove that
$n(A \cup B \cup C) = [n(A) + n(B) + n(C) + n(A \cap B \cap C)] - [n(A \cap B) + n(B \cap C) + n(A \cap C)]$.

Q14. In a group of 65 people 40 like cricket, 10 like both cricket and tennis. How many like tennis only and not cricket? How many like tennis?

Q15. In the class of 25 students,12 have taken mathematics, 8 have taken mathematics but not biology. Find the number of students who have taken mathematics and biology and those who have taken biology but not mathematics?

Q16. If A and B are two sets containing 3 and 6 elements respectively what can be the maximum no. of elements in $(A \cup B)$? Find also the minimum no. of elements in $A \cup B$.

Q17. In a group of 52 persons 16 drink tea but not coffee and 33 drink tea find.
(a) How many drink tea and coffee both? (b) How many drink coffee but not tea ?

Q18. In a town of 840 persons, 450 persons read Hindi, 300 read English and 200 read both newspapers. Then, find the number of persons who read neither of the newspapers?

Q19. In a group of 850 persons 600 can speak Hindi and 340 can speak Tamil. Find

(a) How many can speak both Hindi and Tamil. (b) How many can speak Hindi only.

Q20. In a class of a certain school 50 students offered mathematics,42 offered biology and 24 offered both the subjects. Find the no. of students.

(a) Offering mathematics only. (b) Offering biology only.

(c) Offering any of the two subjects.

Q21. In a survey of 200 students of a school, it was found that 120 study mathematics, 90 study physics and 70 study chemistry, 40 study mathematics and physics, 30 study physics and chemistry, 50 study chemistry and mathematics and 20 none of these subjects. Find the number of students who study all the three subjects.

Q22. In a survey of 425 students in 9 schools, it was found that 115 drink apple juice, 160 drink orange juice and 80 drink both apple as well as orange juice. How many drink neither apple juice nor orange juice?

Q23. There are 260 persons with a skin disorder. If 150 has been exposed to the chemical A, 74 to the chemical A and B, find the number of persons exposed to

(a) Chemical A but not chemical B. (b) Chemical B but not chemical A.

Q24. In a survey of 400 students in a school, 100 were listed as taking apple juice, 150 as taking orange juice and 75 were listed as taking both apple as well as orange juice. Find how many students were taking neither apple juice nor orange juice.

Q25. In a class of 35 students, 24 like to play cricket and 16 like to play footbal. Also, each students likes to play at least one of the two games. How many students like to play both cricket and football?

Q26. In a school there are 20 teachers who teach mathematics or physics.Of these, 12 teach mathematics and 4 teach both physics and mathematics. How many teach physics?

Q27. If $A = [i, i + 1]$, where $i \in z$, the set of integers. Find

(a) $A_2 \cup A_3$ (b) $A_3 \cup A_4$ (c) $\bigcup_{i=3}^{7} A_i$

Q28. In a survey of 60 peoples, it was found that 25 read newspapers H, 26 read newspaper T, 26 read newspaper I, '9 read both H and I, 11 read both H and T, 8 read both T and I and 3 read all the three newspapers. Find

(a) The number of peoples who read at least one of the newspapers.

(b) The no. of people who read exactly one newspaper.

Q29. A school awarded 42 medals in hockey, 18 in basket balls and 23 in cricket. If these medals were bagged by a total of 65 students and only 4 students got medals in all the three sports. How many students received medals in exactly two of the three sports.

Q30. A market research group conducted a survey of 1000 consumers and reported that 720 consumers like product A and 450 consumers like product B, what is the least number that must have liked both products?

Q31. In a group of students, 100 students know Hindi, 50 know English and 25 know both. Each of the students knows either Hindi or English. How many students are there in the group?

Q32. In a committee, 50 people speak French, 20 speak Spanish and 10 speak both Spanish and French. How many speak at least one of these two languages?

Q33. In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. How many like tennis only and not cricket? How many like tennis?

Q34. In a group of 70 people, 37 like coffee, 52 like tea and each person likes at least one of the two drinks. How many people like both coffee and tea?

Q35. In a group of 400 people, 250 can speak Hindi and 200 can speak English. How many people can speak both Hindi and English?

Q36. A college awarded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?

Q37. A class has 175 students the following description gives the number of students studying one or more of the subjects in this class. Mathematics 100 physics 70, chemistry 46, mathematics and physics 30, mathematics and chemistry 28, physics and chemistry 23, mathematics, physics and chemistry 18. Find

(a) How many students are enrolled in mathematics alone, physics alone and chemistry alone?

(b) The number of students who have not offered any of these subjects.

Q38. There are 200 individuals with a skin disorder, 120 had been exposed to the chemical C_1, 50 to chemical C_2 and 30 to both the chemicals C_1 and C_2. Find the number of individuals exposed to

(i) Chemical C_1 but not to chemical C_2 (ii) Chemical C_2 but not chemical C_1

(iii) Chemical C_1 or chemical C_2.

Q39. In a survey of 100 students the number of students studying the various languages is found as : English only 18, English but not Hindi 23, English and Sanskrit 8, Sanskrit and Hindi 8, English 26, Sanskrit 48 and no language 24. Find

(a) How many students are studying Hindi?

(b) How many students are studying English and Hindi both?

Q40. In a survey it is found that 21 people like product *A*, 26 people like product *B* and 29 like product *C*. If 14 people like products *A* and *B*, 15 people like product *B* and *C*, 12 people like product *C* and *A* and 8 people like all the three products find

(a) How many people are surveyed in all? (b) How many like products *C* only?

Date: 9/10/2021

S1. We know that, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

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

$= -50 + 27 + 35$

$= 12.$

S2. We know that, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$\therefore$ Given $n(X) = 17,\quad n(Y) = 23$ and $n(X \cup Y) = 38$

$\because$ $n(X \cap Y) = 17 + 23 - 38 = 2$

S3. We know that, $n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

$\because$ $(n(X) + n(Y) = 20)$

$\therefore$ $n(X \cup Y) = 20 - 10 = 10$

S4. Given, $n(X \cup Y) = 18,\quad n(X) = 8$ and $n(Y) = 15$

According to addition theorem, we have

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

$\therefore$ $n(X \cap Y) = 8 + 15 - 18 = 5$

S5. Given, $n(A) = 4,\ n(B) = 5,\ n(U) = 7$ and $n(A \cap B) = 2.$

$\therefore$ $n(A \cup B) = 4 + 5 - 2 = 7$

Now $n(A \cup B)' = n(U) - n(A \cup B)$

$= 7 - 7 = 0.$

S6. Let U be the set of car owners investigated, M be the set of persons who owned car A and S be the set of persons who owned car B.

Given that $n(U) = 500,\quad n(M) = 400,\quad n(S) = 200$ and $n(S \cap M) = 50$

Then $n(S \cup M) = n(S) + n(M) - n(S \cap M)$

$= 200 + 400 - 50 = 550$

But $S \cup M \subset U$ implies $n(S \cup M) \le n(U)$.

This is a contradiction. So, the given data is incorrect.

S7. Here, $n(S) = 21,\quad n(T) = 32$ and $n(S \cap T) = 11$

Now, $n(S \cup T) = n(S) + n(T) - n(S \cap T)$

$= 21 + 32 - 11$

$= 53 - 11 = 42.$

S8. Here, $n(X) = 40 \quad n(X \cup Y) = 60$ and $n(X \cap Y) = 10$

Now,
$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$
$$60 = 40 + n(Y) - 10$$
$$n(Y) = 60 - 40 + 10$$
$$= 20 + 10 = 30.$$

S9. Given that, $n(X \cup Y) = 50, \quad n(X) = 28, \quad n(Y) = 32,$ and $n(X \cap Y) = ?$

By using the formula $n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

We find that
$$n(X \cap Y) = n(X) + n(Y) - n(X \cup Y)$$
$$= 28 + 32 - 50 = 10.$$

S10. Let A = set of Indian who like apples.

B = set of Indians who like oranges

Then $n(A) = 73, \quad n(B) = 65$ and $n(A \cup B) = 100$

$$\therefore \quad n(A \cap B) = n(A) + n(B) - n(A \cup B)$$
$$= (73 + 65 - 100) = 38$$

Hence 38% of the Indians like both apples and oranges.

S11. Let A be the set of system programmers hired and B be the set of application programmers hired.

Given, $n(A) = 20, \; n(B) = 30$ and $n(A \cap B) = 5.$

The number of programmes that can be hired is
$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$= 20 + 30 - 5 = 45.$$

So the company must hire 45 programmers.

S12. Failed in English only = (56 – 18) = 38.

Failed in science only = (48 – 18) = 30

Failed in both English and science = 18

Failed in one or both of the subjects = (38 + 30 +18) = 86

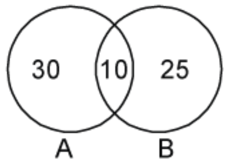
∴ Passed in both the subjects = 100 – 86 = 14

S13. Given,
$$n(A \cup B \cup C) = n[(A \cup B) \cup C]$$
$$= n(A \cup B) + n(C) - n[(A \cup B) \cap C]$$
$$= [n(A) + n(B) - n(A \cap B)] + n(C) - [(A \cap C) \cup (B \cap C)]$$
$$= [n(A) + n(B) + n(C) + n(A \cap B \cap C)]$$
$$- [n(A \cap B) + n(B \cap C) + n(A \cap C)].$$

Hence, the result follows.

S14. Let A = set of peoples who like cricket

B = set people who like tennis.



$n(A)\ \ 40,\ n(A \cap B) = 10$

$\therefore \quad n(A - B) = (40 - 10) = 30$

$n(B - A) = 65 - (30 + 10) = 25$

Number of people who like tennis only = 25

No. of people who like tennis = 25 + 10 = 35

S15. Let A and B be the sets of students who have taken mathematics and biology respectively.

Then $(A - B)$ is the set of students who have taken mathematics but not biology. So $n(A) = 12$, $n(A \cup B) = 25$, $n(A - B) = 8$.

We have, $\quad n(A - B) + n(A \cap B) = n(A)$

$\Rightarrow \quad n(A \cap B) = 12 - 8 = 4.$

Thus, 4 students have taken both mathematics and biology.

Again, $\quad n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$\therefore \quad n(B) = 17$

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

$\therefore \quad n(B - A) = 17 - 4 = 13.$

Hence 13 students have taken biology but not mathematics.

S16. Since, $\quad n(A \cup B) = n(A) + n(B) - n(A \cap B) \quad \ldots \text{(i)}$

Case-I:

From first it is clear that $n(A \cup B)$ will be maximum when $n(A \cap B) = 0$.

In this case $\quad n(A \cup B) = n(A) + n(B)$

$= 3 + 6 = 9$

$\therefore$ Maximum number of elements in $n(A \cup B) = 9$

Case-II:

From (i) it is clear that $n(A \cup B)$ will be minimum when $n(A \cap B)$ is maximum.

$n(A \cap B) = 3$

In this case $\quad n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 3 + 6 - 3 = 6$

Hence minimum number of elements in $n(A \cup B) = 6$.

S17. Let A = set of person who drink tea and B is a set of persons who drink coffee.

Then $\quad (A - B)$ = set of persons who drink tea but not coffee.

Given, $\quad n(A \cup B) = 52,\ \ n(A - B) = 16$ and $n(A) = 33$

(a) Set of persons who drink tea and coffee both = $n(A \cap B)$

Now, $n(A - B) + n(A \cap B) = n(A)$

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

$= 33 - 16 = 17$

Thus 17 drink tea and coffee both

(b) Here, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$\therefore \quad n(B) = 52 + 17 - 33 = 36$

Now, $n(B - A) + n(A \cap B) = n(B)$

$\Rightarrow \quad n(B - A) = 36 - 17 = 19$

Thus no. of persons who drink coffee but not tea = 19.

S18. Let H and E denote Hindi and English newspapers.

Given total no. of persons $n(U) = 840$.

Total no. of persons who read Hindi newspaper.

$n(H) = 450$ and

Similarly, $n(E) = 300$ and

$n(H \cap E) = 200$

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

$= 450 + 300 - 200 = 550$

$\therefore$ The number of persons who read neither of the newspaper.

$n(H' \cap E') = n(H \cup E)'$ (by Demorgan's law)

$= n(U) - n(H \cup E)$

$= 840 - 550 = 290$

Hence 290 person read neither of the newspapers.

S19. Let, A = Set of persons who can speak Hindi and B = Set of persons who can speak Tamil.

$\therefore \quad n(A) = 600, \; n(B) = 340$ and $n(A \cup B) = 850$

(a) Set of persons who can speak both Hindi and Tamil is equal to $n(A \cap B)$

$n(A \cap B) = n(A) + n(B) - n(A \cup B) = 600 + 340 - 850 = 90$

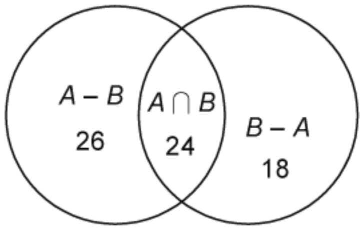
Thus 90 persons can speak both Hindi and Tamil.

(b) Set of persons who can speak Hindi only is $(A - B)$.

Now, $n(A - B) = n(A) - n(A \cap B) = (600 - 90) = 510.$

Thus 510 persons can speak Hindi only.

S20. Let A = set of students offered mathematics and B = set of students offered Biology.



Given, $n(A - B) + n(A \cap B) = 50$

$n(B - A) + n(A \cap B) = 42$

$n(A \cap B) = 24$

(a) $n(A - B) = 50 - 24 = 26$

(b) $n(B - A) = (42 - 24) = 18$

(c) Required no. $= n(A \cup B) = 68$

S21. Let M, P and C denote the students studying mathematics, physics and chemistry respectively. Then we have

$$n(U) = 200,\ n(M) = 120,\ n(P) = 90,\ n(C) = 70$$

$$n(M \cap P) = 40,\ n(P \cap C) = 30,\ n(M \cap C) = 50 \text{ and } n(M \cap P \cup C)' = 20$$

Now, $n(M \cup P \cup C)' = n(U) - n(M \cup P \cup C)$

$\Rightarrow$ $n(M \cap P \cap C) = 180$

We know that

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

Putting above values, we get

$$n(N \cap C \cap M) = 20$$

Hence 20 students study all the three subjects.

S22. Let, U = set of all students surveyed.

A = set of all students who drink apple juice.

B = set of all students who drink orange juice.

Then, $n(U) = 425,\ n(A) = 115,\ n(B) = 160$, and $n(A \cap B) = 80$.

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

$= 115 + 160 - 80 = 195$

Set of students who drink neither apple juice nor orange juice.

$= (A' \cap B') = (A \cup B)'$ (by Demorgan's law)

$\Rightarrow$ $n(A \cup B)' = n(U) - n(A \cup B)$

$= 425 - 195 = 230$

Hence 230 students drink neither apple juice, nor orange juice.

S23. Let, U = set of all persons with skin disorder.

A = set of persons exposed to chemical A.

B = set of persons exposed to chemical B.

Thus, $n(U) = 260,\ n(A) = 150,\ n(B) = 74$ and $n(A \cap B) = 36$

(a) Set of persons exposed to chemical A but not $B = (A - B)$.

Now, $n(A - B) + n(A \cap B) = n(A)$

$\Rightarrow \quad n(A - B) = 150 - 36 = 114$

$\therefore$ Number of persons exposed to chemical A but not $B = 114$.

(b) Set of persons exposed to chemical B but not $A = (B - A)$.

Now, $n(B - A) = 74 - 36 = 38$

$\therefore$ Number of persons exposed to chemical B but not $A = 38$.

S24. Let U denote the set of surveyed students and A denote the set of students taking apple juice and B denote the set of students taking orange juice. Then

$$n(U) = 400, \quad n(A) = 100, \quad n(B) = 150 \quad \text{and} \quad n(A \cap B) = 75$$

Now,
$$\begin{aligned} n(A' \cap B') &= n(A \cup B)' \\ &= n(U) - n(A \cup B) \\ &= n(U) - n(A) - n(B) + n(A \cap B) \\ &= 400 - 100 - 150 + 75 = 225. \end{aligned}$$

Hence, 225 students were taking neither apple juice nor orange juice.

S25. Let X be the set of students who like to play cricket and Y be the set of students who like to play football. Then $X \cup Y$ is the set of students who like to play at least one game, and $X \cap Y$ is the set of students who like to play both games.

Given, $n(X) = 24, \quad n(Y) = 16, \quad n(X \cup Y) = 35, \quad n(X \cap Y) = ?$

Using the formula $n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$,

We get $35 = 24 + 16 - n(X \cap Y)$

Thus, $n(X \cap Y) = 5$

i.e., 5 students like to play both games.

S26. Let M denote te set of teachers who teach mathematics and P denote the set of teachers who teach physics. In the statement of the problem, the word 'or' gives us a clue of union, the word and gives us a clue of intersection. We therefore, have

$$n(M \cup P) = 20 \quad n(M) = 12 \quad \text{and} \quad n(M \cap P) = 4$$

We wish to determine $n(P)$

Using the result

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

We obtain $20 = 12 + n(P) - 4$

Thus, $n(P) = 12$

Hence, 12 teachers teach physics.

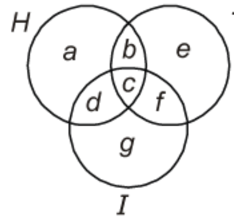
S27. (a) $A_2 = [2, 3]$, $A_3 = [3, 4]$, $A_4 = [4, 5]$

$\therefore \quad A_2 \cup A_3 = [2, 4]$

(b) $A_3 \cup A_4 = [3, 5]$

(c)
$$\bigcup_{i=3}^{7} A_i = A_3 \cup A_4 \cup A_5 \cup A_6 \cup A_7$$
$$= [3, 4] \cup [4, 5] \cup [5, 6] \cup [6, 7] \cup [7, 8]$$
$$= [3, 8]$$

S28. We have



$$a + b + c + d = 25$$
$$b + c + e + f = 26$$
$$c + d + f + g = 26$$

$c + d = 9$, $b + c = 11$, $c + f = 8$, and $c = 3$

After solving, we get

$f = 5$, $b = 8$, $d = 6$, $c = 3$, $g = 12$, $e = 10$, and $a = 8$

(a) Number of people who read at least one of the papers = $(a + b + c + d + e + f + g) = 52$

(b) Number of people who read exactly one newspaper = $(a + e + f) = (8 + 10 + 12) = 30$

S29. Let A, B, C denotes the set students who bagged medals in hockey basketballs and cricket respectively.

Then, $n(A) = 42$, $n(B) = 18$, $n(C) = 23$

$n(A \cup B \cup C) = 65$ and $n(A \cap B \cap C) = 4$

Then, $n(A \cup B \cup C) = [n(A) + n(B) + n(C) + n(A \cap B \cap C)]$

$- [n(A \cap B) + n(B \cap C) + n(A \cap C)]$

$\Rightarrow \quad 65 = (42 + 18 + 23 + 4) - x$

$\Rightarrow \quad x = 22$

S30. Let U be the set of consumers questioned, S be the set of consumers whho liked the product A and T be the set of consumers who like the product B. Gives that

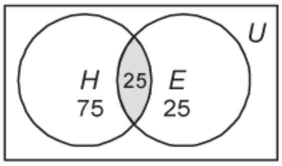
$$n(U) = 1000, \quad n(S) = 720, \quad n(T) = 450$$

So, $n(S \cup T) = n(S) + n(T) - n(S \cap T)$

$= 720 + 450 - n(S \cap T) = 1170 - n(S \cap T)$

Therefore, $n(S \cup T)$ is maximum when $n(S \cap T)$ is least. But $S \cup T \subset U$ implies $n(S \cup T) \leq n(U) = 1000$. So, maximum values of $n(S \cup T)$ is 1000. Thus, the least value of $n(S \cap T)$ is 170. Hence, the least number of consumers who liked both products is 170.

S31. Let H = set of students who know Hindi and E = set of students who know English



Here $n(H) = 100$

$n(E) = 50$

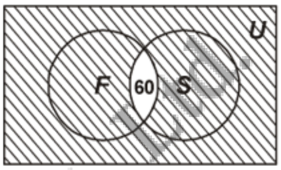
and $n(H \cap E) = 25$

We know that

$$n(H \cup T) = n(H) + n(E) - n(H \cap E)$$
$$= 100 + 50 - 25$$
$$= 125$$

Hence, there are 125 students in the group.

S32. Let F = the set of people who speak French and S = the set people who speak Spanish.



Then $n(F) = 50$

$n(S) = 20$

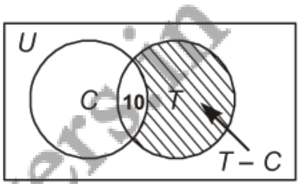
$n(F \cap S) = 10$

As $n(F \cup S) = n(F) + n(S) - n(F \cap S)$

$= 50 + 20 - 10 = 60$

Hence, 60 people speak at least one of these two languages.

S33. Let C = the set of people who like cricket and T = the set of people who like tennis.



Then $n(C \cup T) = 65$

$n(C) = 40$

$n(C \cap T) = 10$

We know that

$$n(C \cup T) = n(C) + n(T) - n(C \cap T)$$

$\Rightarrow$ $65 = 40 + n(T) - 10$

$\Rightarrow$ $n(T) = 65 - 30 = 35$

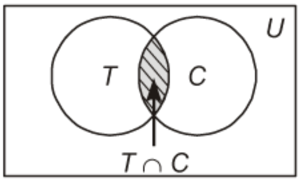
Number of poeple who like only tennis

$= n(T) - n(C \cap T)$

$= 35 - 10 = 25$

Hence, number of people who like tennis is 35 and number of people who like tennis only is 25.

S34. Let C = Set of people who like Coffee and T = Set of people who like tea.



Then $n(C \cup T) = 70$

$n(C) = 37$

$n(T) = 52$

$n(C \cap T) = ?$

We know that

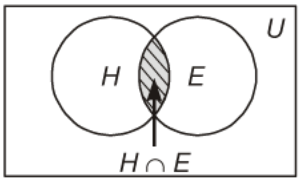
$$n(C \cup T) = n(C) + n(T) - n(C \cap T)$$

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

$\Rightarrow$ $$n(C \cap T) = 89 - 70 = 19$$

Hence, 19 people like both coffee and tea.

S35. Let H = Set of people who can speak Hindi and E = Set of people who can speak English



Then, $$n(H) = 250$$

$$n(E) = 200$$

and $$n(H \cup E) = 400$$

Now, $$n(H \cup E) = n(H) + n(E) - n(H \cap E)$$

$\Rightarrow$ $$400 = 250 + 200 - n(H \cap E)$$

$\Rightarrow$ $$n(H \cap E) = 450 - 400 = 50$$

Hence, 50 people can speak both Hindi and English.

S36. Let F, B and C denote the set of men who received medals in football, basketball and cricket, respectively.

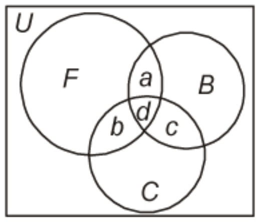
Then, $$n(F) = 38, \quad n(B) = 15, \quad n(C) = 20$$

$$n(F \cup B \cup C) = 58 \quad \text{and} \quad n(F \cap B \cap C) = 3$$

Therefore, $$n(F \cup B \cup C) = n(F) + n(B) + n(C) - n(F \cap B) - n(F \cap C) - n(B \cap C) + n(F \cap B \cap C).$$

gives $$n(F \cap B) + n(F \cap C) + n(B \cap C) = 18$$

Consider the Venn diagram as given in the figure.



Here a denotes the number of men who got medals in football and basketball only. b denotes the number of men who got medals in football and cricket only, c denotes the number of men who got medals in basketball and cricket only and d denotes the number of men who got medal in all the three. Thus,

$$d = n(F \cap B \cap C) = 3 \quad \text{and} \quad a + d + b + d + c + d = 18$$

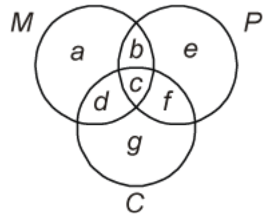
Therefore, $$a + b + c = 9$$

which is the number of people who got medals in exactly two of the three sports.

S37. Let M, P, C denote the sets of students enrolled in mathematics, physics and chemistry respectively, as shown in given figures

Let us denote the number of elements contained in bounded regions by small letters a, b, c, d, e, f, g. as shown in figure using the given data, we have

$$a + b + c + d = 100$$
$$b + c + e + f = 70$$
$$c + d + f + g = 46$$
$$b + c = 30$$
$$c + d = 28$$
$$c + f = 23$$
$$c = 18$$



Solving these eq. we get

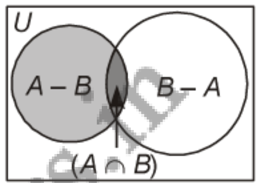
$$c = 18,\ f = 5,\ d = 10,\ b = 12,\ g = 13,\ e = 35 \text{ and } a = 60.$$

(a) Number of students enrolled in mathematics alone (a) = 60, physics alone (e) = 85, chemistry alone (g) = 13.

(b) Number of students not offering any of these subjects.

$$= 175 - (a + b + c + d + e + f + g)$$
$$= 175 - 153 = 32$$

S38. Let U denote the universal set consisting of individuals suffering from the skin disorder, A denote the set of individuals exposed to the chemical C_1 and B denote the set of individuals exposed to the chemical C_2.



Here $\quad n(U) = 200, \quad n(A) = 120, \quad n(B) = 50 \quad \text{and} \quad n(A \cap B) = 30$

(i) From the venn diagram given in the figure, we have

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

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

or $\quad n(A - B) = n(A) - n(A \cap B) = 120 - 30 = 90$

Hence, the number of individuals exposed to chemical C_1 but not to chemical C_2 is 90.

(ii) From the figure, we have

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

and so, $\quad n(B) = n(B - A) + n(A \cap B) \quad [\text{Since } B - A \text{ and } A \cap B \text{ are disjoint}]$

or $\quad n(B - A) = n(B) - n(A \cap B)$

$$= 50 - 30 = 20$$

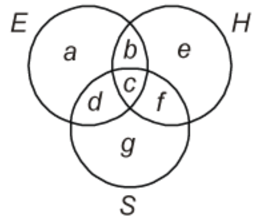
Thus, the number of individuals exposed to chemical C_2 and not to chemical C_1 is 20.

(iii) The number of individuals exposed either to chemical C_1 or to chemical C_2, *i.e.*,

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$= 120 + 50 - 30 = 140.$$

S39. We have,

$$a = 18,\ a + d = 23$$
$$c + d = 8$$
$$c + f = 8$$
$$a + b + c + d = 26$$
$$c + d + f + g = 48$$
$$(a + b + c + d + e + f + g) = 100 - 24 = 76$$



$\therefore$ $a = 18,\ d = 5,\ c = 3,\ f = 5,\ b = 0$

$\therefore$ $g = 48 - (3 + 5 + 5) = 35$

and $e = 76 - (18 + 0 + 3 + 5 + 5 + 35) = 10$

(a) no. of students studying English and Hindi = $(b + c + e + f) = (0 + 3 + 10 + 5) = 18$

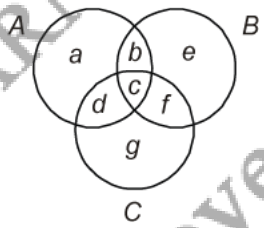
(b) no. of students studying English and Hindi both = $(b + c) = (0 + 3) = 3$

S40. Let A, B, C denotes respectively the set of people who like product A, B, C respectively, as shown in given figure.

Let us denote the number of elements contained in bounded region by a, b, c, d, e, f, g respectively.

Then we have

$$a + b + c + d = 21$$
$$b + c + e + f = 26$$
$$c + d + f + g = 29$$
$$b + c = 14$$
$$c + f = 15$$
$$c + d = 12 \text{ and } c = 8$$



$\therefore$ After solving these equations we get,

$c = 8,\ d = 4,\ f = 7,\ b = 6,\ g = 10,\ e = 5,\ a = 3$

(a) Total no. of surveyed people

$$= (a + b + c + d + e + f + g) = 43$$

(b) Numbered persons who like product C only $(g) = 10$