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Q1. Write the following sets in the roaster form.

(i) $A = \{x \mid x$ is a positive integer less than 10 and $2^x - 1$ is an odd number$\}$.

(ii) $C = \{x : x^2 + 7x - 8 = 0, x \in \mathbb{R}\}$.

Q2. Given that N = {1, 2, 3, ..., 100}, then

(i) Write the subset A of N, whose element are odd numbers.

(ii) Write the subset B of N, whose element are represented by $x + 2$, where $x \in N$.

Q3. Given that $N = \{1, 2, 3, ..., 100\}$, then write

(i) the subset of N whose elements are even number.

(ii) the subsets of N whose elements are perfect square subset.

Q4. If X and Y are subsets of the universal set U, then show that $Y \subset X \cup Y$.

Q5. If X and Y are subsets of the universal set U, then show that $X \subset Y \Rightarrow X \cap Y = X$.

Q6. If X and Y are subsets of the universal set U, then show that $X \cap Y \subset X$.

Q7. If $Y = \{x \mid x$ is a positive factor of the number $2^{p-1}(2^p - 1)$, where $2^p - 1$ is a prime number$\}$. Write Y in the roaster form.

Q8. For all sets A and B show that

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

Q9. For all sets A, B and C, show that

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

Q10. A, B and C are subsets of Universal set U. If $A = \{2, 4, 6, 8, 12, 20\}$, $B = \{3, 6, 9, 12, 15\}$, $C = \{5, 10, 15, 20\}$ and U is the set of all whole numbers, draw a Venn diagram showing the relation of U A, B and C.

Q11. Given: $L = \{1, 2, 3, 4\}$, $M = \{3, 4, 5, 6\}$ and $N = \{1, 3, 5\}$.

Verify that: $L - (M \cup N) = (L - M) \cap (L - N)$.

Q12. Use the properties of sets to prove that for all the sets A and B

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

Q13. Let A, B and C be sets. Then show that

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

Q14. For all sets A and B show that

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

Q15. For all sets A and B show that

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

Q16. For all sets A and B show that

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

Q17. Let U be the set of all boys and girls in a school, G be the set of all girls in the school, B be the set of all boys in the school and S be the set of all students in the school who take swimming. Some, but not all, students in the school take swimming. Draw a Venn diagram showing one of the possible inter-relationship among U, G, B and S.

Q18. Given that $E = \{2, 4, 6, 8, 10\}$. If n represents any member of E, then write the following sets containing all numbers represented by: (i) $n + 1$; (ii) n^2.

Q19. Let $X = \{1, 2, 3, 4, 5, 6\}$. If n represent any member of X, express the following as sets:

(i) $n \in X$ but $2n \notin X$ (ii) $n + 5 = 8$ (iii) n is greater than 4.

Q20. If $X = \{1, 2, 3\}$, if n represents any number of X. Write the following sets containing all numbers represented by:

(i) $4n$ (ii) $n + 6$ (iii) $\frac{n}{2}$ (iv) $n - 1$

Q21. Write the following sets in the roaster form:

(i) $D = \{t \mid t^3 = t, t \in R\}$ (ii) $E = \left\{w \mid \frac{w-2}{w+3} = 3, w \in R\right\}$

(iii) $F = \{x \mid x^4 - 5x^2 + 6 = 0, x \in R\}$.

Q22. Write the following sets in the roaster form:

(i) $A = \{x : x \in R, 2x + 11 = 15\}$ (ii) $B = \{x \mid x^2 = x, x \in R\}$

(iii) $C = \{x \mid x$ is a positive factor of a prime number $p\}$.

Q23. Let P be the set of prime numbers and let $S = \{t \mid 2^t - 1$ is a prime$\}$. Prove that $S \subset P$.

Q24. Draw the Venn diagrams to illustrate the following relationship among sets E, M and U, where E is the set of students studying English in a school, M is the set of students studying Mathematics in the same school, U is the set of all students in that school.

(i) All the students who study Mathematics study English, but some students who study English do not study Mathematics.

(ii) There is no student who studies both Mathematics and English.

(iii) Some of the students study Mathematics but do not study English, some study English but do not study Mathematics, and some study both.

(iv) Not all students study Mathematics but every students studying English studies Mathematics.

Q25. If $Y = \{1, 2, 3, ..., 10\}$, and "a" represents any element of X, write the following sets containing all the elements satisfying the given conditions:

(i) $a \in Y$ but $a^2 \notin Y$ (ii) $a + 1 = 6, a \in Y$ (iii) a is less than 6 and $a \in Y$.

Q26. In a class of 60 students, 25 students play cricket and 20 students play tennis and 10 students play both the games. Find the number of students who play neither.

Q27. In a survey 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.

Q28. From 50 students taking examinations in Mathematics, Physics and Chemistry, each of the student has passed in at least one of the subject, 37 passed Mathematics, 24 Physics and 43 Chemistry. At most 19 passed Mathematics and Physics, at most 29 Mathematics and Chemistry and at most 20 Physics and Chemistry. What is the largest possible number that could have passed all three examination?

Q29. Let A, B and C be sets. Then show that

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

Q30. If A and B are subsets of the universal set U, then show that:

(i) $A \subset A \cup B$ (ii) $A \subset B \leftrightarrow A \cup B = B$ (iii) $(A \cap B) \subset A$.

Q31. For all sets A, B and C. Is $(A - B) \cap (C - B) = (A \cap C) - B$? Justify your statement.

Q32. For all sets A, B and C. Is $(A \cap B) \cup C = A \cap (B \cup C)$? Justify your statement.

Q33. In a town of 10,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B, 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C. If 2% families buy all the three newspapers. Find

(i) the number of families which buy newspaper A only.

(ii) the number of families, which buy none of A, B and C.

Q34. In a group of 50 students, the number of students studying French, English, Sanskrit were found to be as follows: French = 17, English = 13, Sanskrit = 15, French and English = 9, English and Sanskrit = 4, French and Sanskrit = 5 and students studying all subjects = 3.

Find the number of students who study:

(i) French only
(ii) English only
(iii) Sanskrit only
(iv) English and Sanskrit but not French
(v) French and Sanskrit but not English
(vi) French and English but not Sanskrit
(vii) At least one of the three languages
(viii) None of the three languages.

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S1. (i) $2^x - 1$ is always an odd number fo all positive integral values of x. In particular, $2^x - 1$ is an odd number for $x = 1, 2, ..., 9$. Thus, A = {1, 2, 3, 4, 5, 6, 7, 8, 9}.

(ii) $x^2 + 7x - 8 = 0$ or $(x + 8)(x - 1) = 0$, giving $x = -8$ or $x = 1$. Thus, $C = \{-8, 1\}$.

S2. (i) $A = \{x \mid x \in N \text{ and } x \text{ is odd}\} = \{1, 3, 5, 7, .., 99\}$.

(ii) $B = \{y \mid y = x + 2, x \in N\}$.

So, for $1 \in N, \quad y = 1 + 2 = 3$

$2 \in N, \quad y = 2 + 2 = 4$

and so on, therefore, $B = \{3, 4, 5, 6, ..., 100\}$.

S3. (i) Let $N = \{1, 2, 3, \ldots, 100\}$

$\therefore$ Required subset = {{2, 4, 6, ..., 100}

(ii) Required subset = {{1, 4, 9, 16, 25, 36, 64, 81, 100}.

S4. Let $X \cup Y = \{x \mid x \in X \text{ or } x \in Y\}$

Thus, $x \in Y \Rightarrow x \in X \cup Y$

Hence, $Y \subset X \cup Y$.

S5. Note that $x \in X \cap Y \Rightarrow x \in X$

Thus, $X \cap Y \subset X$

Also, since $X \subset Y$

$x \in X \Rightarrow x \in Y \Rightarrow x \in X \cap Y$

So that, $X \subset X \cap Y$

Hence the result $X = X \cap Y$ follows.

S6. Let $X \cap Y = \{x \mid x \in X \text{ or } x \in Y\}$

Thus, $x \in X \cap Y \Rightarrow x \in X$

Hence, $X \cap Y \subset X$.

S7. Consider $2^{p-1}(2^p - 1)$.

Clearly, $Y = \{2, 2^2, 2^3, ..., 2^{p-1}, 2^p - 1\}$.

S8. Let, R.H.S. $= A \cup (B - A)$

$= A \cup [B \cap A']$

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

$= A \cup B \cap U$

$= A \cup B =$ R.H.S

S9. Let, $x \in (A - B) \cap (C - B)$

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

$\Rightarrow$ $(x \in A$ and $x \notin B)$ and $x \in C$ and $x \notin B$

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

$\Rightarrow$ $x \in A \cap \text{C}$ and $x \notin B$

$\Rightarrow$ $x \in A \cap C - B$

Again, $x \in A - (B \cup C)$

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

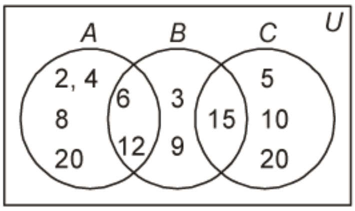
$x \in A$ and $x \notin C$ and $x \notin B$

$x \in (A \cup C)$ and $x \notin B$

$x \in A \cup C - B$

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

S10.



S11. Let L.H.S. $= L - (M \cup N)$

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

$= \{2\}$

R.H.S. $= (L - M) \cap (L - N)$

$= [\{1, 2, 3, 4\} - \{3, 4, 5, 6\}] \cap [\{1, 2, 3, 4\} - \{1, 3, 5\}]$

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

Thus, L.H.S. = R.H.S.

S12. We have, $A - (A \cap B) = A \cap (A \cap B)'$ (since $A - B = A \cap B'$)

$= A \cap (A' \cup B')$ [By De Morgan's Law]

$= (A \cap A') \cup (A \cap B')$ [By Distributive Law]

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

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

S13. Let $x \in A \cap (B \cap C)$

$\Rightarrow$ $x \in A$ and $x \in (B \cap C\}$

$\Rightarrow$ $x \in A$ and $\{x \in B$ and $x \in C\}$

$\Rightarrow$ $(x \in A$ and $x \in B)$ and $(x \in A$ and $x \in C)$

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

$\Rightarrow$ $x \in (A \cap B) \cup (A \cap C)$.

S14. Let

$$\begin{aligned} \text{L.H.S.} &= (A \cup B) - B \\ &= (A \cup B) \cap B' \\ &= (A \cap B') \cup (B \cap B') \\ &= (A \cap B') \cup \phi \\ &= A \cap B' \\ &= A - B = \text{R.H.S.} \end{aligned}$$

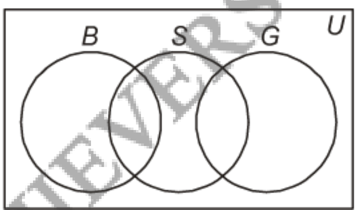
S15. Let

$$\begin{aligned} \text{L.H.S.} &= A - (A \cap B) \\ &= A \cap (A \cap B)' \\ &= A \cap (A' \cup B') \\ &= (A \cap A') \cup (A \cap B') \\ &= \phi \cup (A \cap B') \\ &= (A \cap B') \\ &= A - B = \text{R.H.S.} \end{aligned}$$

S16. Let

$$\begin{aligned} \text{L.H.S.} &= A - (A - B) \\ &= A \cap (A - B)' \\ &= A \cap (A \cap B')' \\ &= A \cap (A' \cup B) \\ &= (A \cap A') \cup (A \cap B) \\ &= \phi \cup (A \cap B) \\ &= A \cap B = \text{R.H.S.} \end{aligned}$$

S17.



S18. Given, $E = \{2, 4, 6, 8, 10\}$

(i) Let $A = \{x \mid x = n + 1, n \in E\}$

Thus, for $2 \in E, \quad x = 3$

$4 \in E, \quad x = 5$

and so on. Therefore, $A = \{3, 5, 7, 9, 11\}$.

(ii) Let $B = \{x \mid x = n^2, n \in E\}$

So, for $2 \in E, \quad x = (2)^2 = 4$

$4 \in E, \quad x = (4)^2 = 16$

$6 \in E, \quad x = (6)^2 = 36$

and so on. Hence, $B = \{4, 16, 36, 64, 100\}$.

S19. (i) For, $X = \{1, 2, 3, 4, 5, 6\}$, it is the given that $n \in X$, but $2n \notin X$.

Let $A = \{x \mid x \in X \text{ and } 2x \notin X\}$

Now, $1 \notin A$ as $2.1 = 2 \in X$

$2 \notin A$ as $2.2 = 4 \in X$

$3 \notin A$ as $2.3 = 6 \in X$

But, $4 \in A$ as $2.4 = 8 \notin X$

$5 \in A$ as $2.5 = 10 \notin X$

$6 \in A$ as $2.6 = 12 \notin X$

So, $A = \{4, 5, 6\}$

(ii) Let $B = \{x \mid x \in X \text{ and } x + 5 = 8\}$

Here, $B = \{3\}$

as $x = 3 \in X$ and $3 + 5 = 8$ and there is no other element belonging to such that $x + 5 = 8$.

(iii) Let $C = \{x \mid x \in X, x > 4\}$

Therefore, $C = \{5, 6\}$.

S20. (i) When, $n = 1, 2, 3$

$\therefore$ $4n = 4, 8, 12$

$\therefore$ Required subset = $\{4, 8, 12\}$.

(ii) When, $n = 1, 2, 3$

$\therefore$ $n + 6 = 7, 8, 9$

$\therefore$ Required subset = $\{7, 8, 9\}$.

(iii) When, $n = 1, 2, 3$

$\therefore$ $\frac{n}{2} = \frac{1}{2}, 1, \frac{3}{2}$

$\therefore$ Required subset = $\left\{\frac{1}{2}, 1, \frac{3}{2}\right\}$.

(iv) When, $n = 1, 2, 3$

$\therefore$ $n - 1 = 0, 1, 2$

$\therefore$ Required subset = $\{0, 1, 2\}$.

S21. (i) Given, $D = \{t \mid t^3 = t, t \in R\}$

Let $t^3 = t \Rightarrow t^3 - t = 0$

$\Rightarrow t(t^2 - 1) = 0$

$\Rightarrow t = 0, -1, 1$

$D = \{0, -1, 1\}$

(ii) Let, $E = \left\{w \mid \frac{w-2}{w+3} = 3, w \in R\right\}$

$\frac{w-2}{w+3} = 3 \quad \Rightarrow \quad w - 2 = 3w + 9$

$\Rightarrow \quad 3w + 9 = w - 2$

$\Rightarrow \quad 2w = -11$

$\Rightarrow \quad w = -\frac{11}{2}$

$E = \left\{-\frac{11}{2}\right\}$

(iii) Let, $F = \{x \mid x^4 - 5x^2 + 6 = 0, x \in R\}$

$x^4 - 5x^2 + 6 = 0$

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

$\Rightarrow \quad x^2 = 2, 3$

$\Rightarrow \quad x = [\pm\sqrt{2}, \pm\sqrt{3}]$

Hence, $F = [\sqrt{2}, -\sqrt{2}, \sqrt{3}, -\sqrt{3}]$.

S22. (i) Given, $A = \{x : x \in R, 2x + 11 = 15\}$

$2x + 11 = 15 \quad \Rightarrow \quad 2x = 4 \quad \Rightarrow \quad x = 2$

$\therefore \quad A = \{2\}$.

(ii) Let, $B = \{x \mid x^2 = x, x \in R\}$

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

$\Rightarrow \quad x = 0, 1$

Hence, $B = \{0, 1\}$.

(iii) $C = \{x \mid x$ is a positive factor of a prime number $p\}$.

Clearly, $C = \{p, 1\}$.

S23. Now the equivalent contrapositive statemnt of $x \in S = x \in P$ is $x \notin P = x \notin S$.

Now, we will prove the above contrapositive statement by contradiction method

Let $x \notin P$

$\Rightarrow$ x is a composite number

Let us now assume that $x \in S$

$\Rightarrow \quad 2^x - 1 = m$ (where m is a prime number)

$\Rightarrow \quad 2^x = m + 1$

Which is not true for all composite number, say for $x = 4$ because

$2^4 = 15$ which can not be equal to the sum of any prime number m and 1.

Thus, we arrive at a contradiction

$\Rightarrow$ $x \notin S$

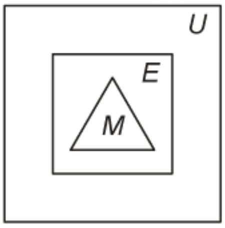
Thus when $x \notin P$, we arrive at $x \notin S$

So, $S \subset P$.

S24. (i) Since all of the students who study Mathematics study English, but some students who study English do not study Mathematics.

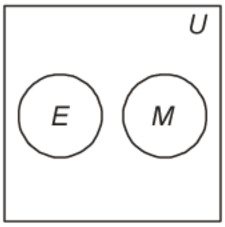
Therefore, $M \subset E \subset U$

Thus, the Venn Diagram is



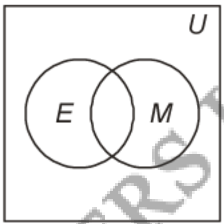
(ii) Since there is no student who study both English and Mathematics

Hence, $E \cap M = \phi$.



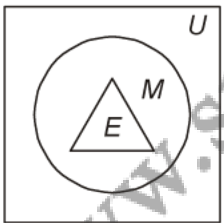
(iii) Since there are some students who study both English and Mathematics, some English only and some Mathematics only.

Thus, the Venn Diagram is



(iv) Since every student studying English studies Mathematics.

Hence, $E \subset M \subset U$



S25. Given, $Y = \{1, 2, 3, ..., 10\}$

(i) $a \in Y$ but $a^2 \notin Y$

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

Hence, Required subset = {4, 5, 6, 7, 8, 9, 10}

(ii) Let $a + 1 = 6, \quad a \in Y$

$\Rightarrow \quad a = 5$

Hence, Required subset = {5}.

(iii) a is less than 6 and $a \in Y$

$\therefore$ Required subset = {1, 2, 3, 4, 5}.

S26. Let C be the set of students playing Cricket and T be the set of students playing Tennis.

Now,
$$n(C) = 25,$$
$$n(T) = 20$$
$$n(C \cap T) = 10$$

Now,
$$n(C \cup T) = n(C) + n(T) - n(C \cap T)$$
$$\Rightarrow \quad n(C \cup T) = 25 + 20 - 10$$
$$\Rightarrow \quad n(C \cup T) = 35$$

Given total number of students = 60.

Hence, number of students who play neither = 60 – 35 = **25**.

S27. Let M be the set of students who study Mathematics, P be the set of students who study Physics and C be the set of students who study Chemistry.

$$\therefore \quad n(M) = 120, \quad n(P) = 90, \quad n(C) = 70$$
$$n(M \cap P) = 40$$
$$n(P \cap C) = 30$$
$$n(C \cap M) = 50$$

Number of students who study none of these subjects = 20.

$$\therefore \quad n(M \cup P \cup C) = 200 - 20 = 180$$

Now,
$$n(M \cup P \cup C) = n(M) + n(P) + n(C) - n(M \cap P) - n(P \cap C) - n(M \cap C) + n(M \cap P \cap C)$$
$$\Rightarrow \quad 180 = 120 + 90 + 70 - 40 - 30 - 50 + n(M \cap P \cap C)$$
$$\Rightarrow \quad 180 = 280 - 120 + n(M \cap P \cap C)$$
$$\Rightarrow \quad 180 = 160 + n(M \cap P \cap C)$$
$$\Rightarrow \quad n(M \cap P \cap C) = 180 - 160 = 20$$

Hence, number of students who study all the three subjects = **20**.

S28. Let M be the set of students passing in Mathematics

P be the set of students passing in Physics

C be the set of students passing in Chemistry

Now, $n(M \cup P \cup C) = 50, \quad n(M) = 37, \quad n(P) = 24, \quad n(C) = 43$

$n\ (M \cap P) \le 19, \quad n(M \cap C) \le 29, \quad n(P \cap C) \le 20 \quad$ (Given)

$$n(M \cup P \cup C) = n(M) + n(P) + n(C) - n(M \cup P) - n(M \cap C) - n(P \cap C) + n(M \cap P \cap C) \le 50$$

$\Rightarrow \quad 37 + 24 + 43 - 19 - 29 - 20 + n(M \cap P \cap C) \le 50$

$\Rightarrow \quad n(M \cap P \cap C) \le 50 - 36$

$\Rightarrow \quad n(M \cap P \cap C) \le 14$

Thus, the largest possible number that could have passed all the three examinations is 14.

S29. We first show that $A \cup (B \cap C) \subset (A \cup B) \cap (A \cup C)$

Let $\quad x \in A \cup (B \cap C)$. Then

$x \in A \quad$ or $\quad x \in B \cap C$

$\Rightarrow \quad x \in A \quad$ or $\quad (x \in B$ and $x \in C)$

$\Rightarrow \quad (x \in A$ or $x \in B)$ and $(x \in A$ or $x \in C)$

$\Rightarrow \quad (x \in A \cup B)$ and $(x \in A \cup C)$

$\Rightarrow \quad x \in (A \cup B) \cap (A \cup C)$

Thus, $\quad A \cup (B \cap C) \subset (A \cup B) \cap (A \cup C) \quad$ ... (i)

Now, we will show that $(A \cup B) \cap (A \cup C) \subset A \cup (B \cap C)$

Let $\quad x \in (A \cup B) \cap (A \cup C)$

$\Rightarrow \quad x \in A \cup B \quad$ and $\quad x \in A \cup C$

$\Rightarrow \quad (x \in A$ or $x \in B)$ and $(x \in A$ or $x \in C)$

$\Rightarrow \quad x \in A$ or $(x \in B$ and $x \in C)$

$\Rightarrow \quad x \in A$ or $(x \in B \cap C)$

$\Rightarrow \quad x \in A \cup (B \cap C)$

Thus, $\quad (A \cup B) \cap (A \cup C) \subset A \cup (B \cap C) \quad$ ... (ii)

So, from Eq. (i) and (ii), we have

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

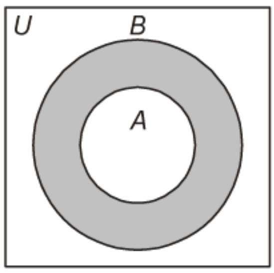
S30. (i) Let $\quad x \in A$

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

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

$\Rightarrow \quad x \in B$

$\therefore \quad A \subset A \cup B.$

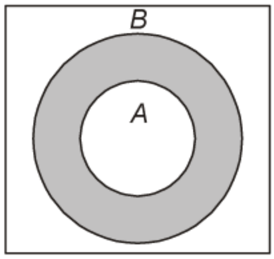


(ii) Let $x \in A$

$\Rightarrow$ $x \in B$

$\in$ $x \in A \cup B$

$\therefore$ $A \cup B = B$

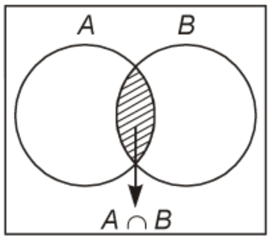


(ii) Let $x \in A \cap B$

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

$\Rightarrow$ $x \in A$

$=$ $A \cap B \subset A.$



S31. Yes. Let $x \in (A - B) \cap (C - B)$

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

$\Rightarrow$ $(x \in A$ and $x \notin B)$ and $(x \in C$ and $x \notin B)$

$\Rightarrow$ $(x \in A$ and $x \in C)$ and $x \notin B$

$\Rightarrow$ $(x \in A \cap C)$ and $x \notin B$

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

So, $(A - B) \cap (C - B) \subset (A \cap C) - B$ ... (i)

Let $y \in (A \cap C) - B$

$\Rightarrow$ $y \in (A \cap C)$ and $y \notin B$

$\Rightarrow$ $(y \in A$ and $y \in C)$ and $(y \notin B)$

$\Rightarrow$ $(y \in A$ and $y \notin B)$ and $(y \in C$ and $y \notin B)$

$\Rightarrow$ $y \in (A - B)$ and $y \in (C - B)$

$\Rightarrow$ $y \in (A - B) \cap (C - B)$

So, $(A \cap C) - B \subset (A - B) \cap (C - B)$ ... (ii)

From Eq. (i) and (ii), $(A - B) \cap (C - B) = (A \cap C) - B$.

S32. No. consider the following sets A, B and C:

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

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

$C = \{4, 5, 6\}$

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

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

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

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

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

$= \{2, 3\}$

$(A \cap B) \cup C \neq A \cap (B \cup C)$.

S33. Let P be the set of families who buy newspaper A, Q be the set of families who buy newspaper B and R be the set of families who buy newspaper C.

Now, $n(P) = 40\%$ of $10{,}000 = 4{,}000$

$n(Q) = 20\%$ of $10{,}000 = 2{,}000$

$n(R) = 10\%$ of $10{,}000 = 1{,}000$

$n(P \cap Q) = 5\%$ of $10{,}000 = 500$

$n(Q \cap R) = 3\%$ of $10{,}000 = 300$

$n(R \cap P) = 4\%$ of $10{,}000 = 400$

$n(P \cup Q \cup R) = 2\%$ of $10{,}000 = 200$

$\therefore$ $n(P \cup Q \cup R) = n(P) + n(Q) + n(R) - n(P \cap Q) - n(Q \cap R) - n(R \cap P) + n(P \cap Q \cap R)$

$= 4{,}000 + 2{,}000 + 1{,}000 - 500 - 300 - 400 + 200$

$= 7{,}000 - 1{,}200 + 200$

$= 6{,}000$

(i) Number of families who buy newspaper A only

$= n(P) - n(P \cap Q) - n(P \cap Q \cap R)$

$= 4{,}000 - 500 - 200$

$=$ **3,300**.

(ii) Number of families who buy none of the newspaper A, B and C

$= 10{,}000 - 6{,}000$

$=$ **4,000**.

S34. Let F denotes the set of students studying French, E denotes the set of students studying English and S denotes the set of students studying Sanskrit.

$\therefore$ $n(F) = 17, \quad n(E) = 13, \quad n(S) = 15$

$n(F \cap E) = 9, \quad n(E \cap S) = 4, \quad n(F \cap S) = 5, \quad n(F \cap E \cap S) = 3$

Now, $n(F \cup E \cup S) = n(F) + n(E) + n(S) - n(F \cap E) - n(E \cap S) - n(F \cap S) + n(F \cap E \cap S)$

$= 17 + 13 + 15 - 9 - 4 - 5 + 3$

$= 48 - 18 = 30$

(i) Number of students who study French only

$$= n(F) - n(F \cap E) - n(F \cap S) + n(F \cap E \cap S)$$

$$= 17 - 9 - 5 + 3 = \mathbf{6}.$$

(ii) Number of students who study English only

$$= n(E) - n(E \cap F) - n(E \cap S) + n(E \cap F \cap S)$$

$$= 13 - 9 - 4 + 3 = \mathbf{3}.$$

(iii) Number of students who study Sanskrit only

$$= n(S) - n(F \cap S) - n(E \cap S) + n(F \cap E \cap S)$$

$$= 15 - 5 - 4 + 3 = \mathbf{9}.$$

(iv) Number of students who study English and Sanskrit but not French

$$= n(E \cap S) - n(F \cap E \cap S)$$

$$= 4 - 3 = \mathbf{1}.$$

(v) Number of students who study French and Sanskrit but not English

$$= n(F \cap S) - n(F \cap E \cap S)$$

$$= 5 - 3 = \mathbf{2}.$$

(vi) Number of students who study French and English but not Sanskrit

$$= n(F \cap E) - n(F \cap E \cap S)$$

$$= 9 - 3 = \mathbf{6}.$$

(vii) Number of students who study atleast one of the three languages

$$= n(F \cup E \cup S) = \mathbf{30}.$$

(viii) Number of students who study none of the three languages

$$= 50 - 30 = \mathbf{20}.$$