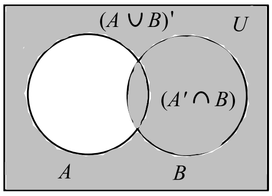
51 **(a)**

From Venn-Euler's Diagram it is clear that



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

52 **(b)**

Number of element is $S = 10$

And $A = \{(x, y); x, y \in S, x \neq y\}$

$\therefore$ Number of element in $A = 10 \times 9 = 90$

53 **(b)**

Given, $A \cap X = B \cap X = \phi$

$\Rightarrow A$ and X, B and X are disjoint sets.

Also, $A \cup X = B \cup X \Rightarrow A = B$

54 **(d)**

Given figure clearly represents

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

55 **(d)**

$X \cap Y = \{1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 100, 200\}$

$\therefore \quad n(X \cap Y) = 12$

56 **(c)**

Given, $n(M) = 100, n(P) = 70, \quad n(C) = 40$

$n(M \cap P) = 30, \quad n(M \cap C) = 28,$

$n(P \cap C) = 23$ and $n(M \cap P \cap C) = 18$

$\therefore n(M \cap P' \cap C') = n[M \cap (P \cap C')]$

$= n(M) - n[M \cap (P \cap C)]$

$= n(M) - [n(M \cap P) + n(M \cap C) - n(M \cap P \cap C)]$

$= 100 - [30 + 28 - 18 = 60]$

57 **(d)**

Required number

$$= \frac{3^4 + 1}{2} = 41$$

58 **(c)**

Given, A's are 30 sets with five elements each, so

$$\sum_{i=1}^{30} n(A_i) = 5 \times 30 = 150$$

...(i)

If the m distinct elements in S and each elements of S belongs to exactly 10 of the A_i's, then

$$\sum_{i=1}^{30} n(A_i) = 10m$$

...(ii)

From Eqs. (i) and (ii), $m = 15$

Similarly, $\sum_{j=1}^{n} n(B_j) = 3n$ and $\sum_{j=1}^{n} n(B_j) = 9m$

$\therefore \quad 3n = 9m$

$\Rightarrow \quad n = \frac{9m}{3} = 3 \times 15 = 45$

59 **(d)**

$\because A = \{(a, b): a^2 + 3b^2 = 28, a, b \in Z\}$

$=\{(5, 1), (-5, -1), (5, -1), (-5, 1), (1, 3), (-1, -3), (-1, 3),$

$(1, -3), (4, 2), (-4, -2), (4, -2), (-4, 2)\}$

And $B = \{(a, b): a > b, a, b \in Z\}$

$\therefore \quad A \cap B$

$= \{(-1, -5), (1, -5), (-1, -3), (1, -3), (4, 2), (4, -$

$\therefore$ Number of elements in $A \cap B$ is 6.

60 **(c)**

Given, $A = \{1, 2, 3\}, B = \{a, b\}$

$\therefore \quad A \times B$

$= \{(1, a), (1, b), (2, a), (2, b), (3, a), (3, b)\}$

61 **(a)**

According to the given condition,

$$2^m = 112 + 2^n$$

$\Rightarrow \quad 2^m - 2^n = 112$

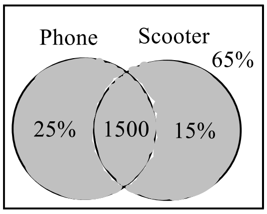
$\Rightarrow \quad m = 7, n = 4$

62 **(b)**

Number of elements common to each set is $99 \times 99 = 99^2$.

63 **(c)**

Let the total population of town be x.



$\therefore \quad \frac{25x}{100} + \frac{15x}{100} - 1500 + \frac{65x}{100} = x$

$\Rightarrow \quad \frac{105x}{100} - x = 1500$

$\Rightarrow \quad \frac{5x}{100} = 1500$

$\Rightarrow \quad x = 30000$

64 **(c)**

$U = \{x: x^5 + 6x^4 + 11x^3 - 6x^2 = 0\} = \{0, 1, 2, 3\}$

$A = \{x: x^2 - 5x + 6 = 0\} = \{2, 3\}$

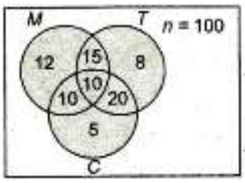
And $B = \{x: x^2 - 3x + 2 = 0\} = \{2, 1\}$

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

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

65 **(b)**

Total drinks=3(*ie*, milk, coffee, tea).



Total number of students who take any of the drink is 80.

∴The number of students who did not take any of three drinks= $100 - 80 = 20$

66 **(c)**

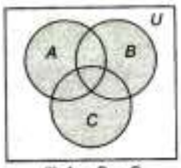
Let $A = \left\{x \in R: \frac{2x-1}{x^3+4x^2+3x}\right\}$

Now, $x^3 + 4x^2 + 3x = x(x^2 + 4x + 3)$

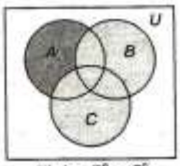
$= x(x+3)(x+1)$

∴ $A = R - \{0, -1, -3\}$

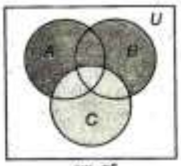
67 **(b)**



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



(ii) $A \cap B^c \cap C^c$



(iii) C^c

From figures (i), (ii) and (iii), we get

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

68 **(b)**

Number of reflexive relations of a set of 4 elements= 2^{4^2-4}

$= 2^{12}$

69 **(a)**

aRa if $|a - a| = 0 < 1$, which is true.

∴ It is reflexive.

Now, aRb,

$|a - b| \leq 1 \Rightarrow |b - a| \leq 1$

$\Rightarrow \quad aRb \Rightarrow bRa$

∴ It is symmetric.

70 **(c)**

In the given options only option (c) satisfies the condition of a function.

Hence, option (c) is a function.

71 **(d)**

Since, R is defined as aRb iff $|a - b| > 0$.

Reflexive : aRa iff $|a - a| > 0$

Which is not true. So, R is not reflexive.

Symmetric : aRb iff $|a - b| > 0$

Now, bRa iff $|b - a| > 0$

$\Rightarrow \quad |a - b| > 0 \quad \Rightarrow \quad aRb$

Thus, R is symmetric.

Transitive : aRb iff $|a - b| > 0$

bRc iff $|b - c| > 0$

$\Rightarrow \quad |a - b + b - c| > 0$

$\Rightarrow \quad |a - c| > 0$

$\Rightarrow \quad |c - a| > 0 \Rightarrow aRc$

Thus, R is also transitive.

72 **(a)**

Since, $(1, 2) \in S$ but $(2, 1) \notin S$

∴ S is not symmetric.

Hence, S is not an equivalent relation.

Given, $T = \{(x, y): (x - y) \in I\}$

Now, $xTx \Rightarrow x - x = 0 \in I$, it is reflexive relation

Again, $xTy \Rightarrow (x - y) \in I$

$\Rightarrow y - x \in I \Rightarrow yTx$ it is symmetric relation.

Let xTy and yTz

∴ $x - y = I_1$ and $y - z = I_2$

Now, $x - z = (x - y) + (y - z) = I_1 + I_2 \in I$

$\Rightarrow x - z \in I$

$\Rightarrow \quad xTz$

∴ T is transitive.

Hence, T is an equivalent relation.

73 **(a)**

$aRb \Leftrightarrow a = 2^k . b$ for some integer.

Reflexive ∴ aRb for $k = 0$

Symmetric $aRb \Leftrightarrow a = 2^k b$

$\Rightarrow b = 2^{-k} a \Leftrightarrow bRa$

Transitive $aRb \Leftrightarrow a = 2^{k_1} b$

$bRc \Leftrightarrow b = 2^{k_2} c$

$\Rightarrow \quad a = 2^{k_1} . 2^{k_2} c$

$\Rightarrow \quad a = 2^{k_1 + k_2} c \Leftrightarrow aRc$

$\Rightarrow aRb, bRc \Rightarrow aRc$

∴ R is an equivalent relation.

74 **(c)**

$R = \{(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)\}$ is a relation on

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

(a) since, $(2, 4) \in R$ and $(2, 3) \in R$, so R is not a function.

(b) since, $(1,3) \in R$ and $(3, 1) \in R$ but $(1, 1) \notin R$. So, R is not transitive.

(c) since, $(2, 3) \in R$ but $(3, 2) \notin R$, so R is not symmetric.

(d) since, $(4, 4) \notin R$, so R is not reflexive.

75 **(d)**

Since, $(3, 3), (6, 6), (9, 9), (12, 12) \in R \Rightarrow R$ is reflexive.

Now, $(6, 12) \in R$ but $(12, 6) \notin R \Rightarrow R$ is not symmetric.

Also, $(3, 6), (6, 12) \in R \Rightarrow (3, 12) \in R$

$\Rightarrow R$ is transitive.