Q1: NTA Test 01 (Single Choice)

If $R = \{(x,\ y)|x,\ y \in Z,\ x^2 + y^2 \leq 4\}$ is a relation in Z , then domain of R is

(A) $\{0,\ 1,\ 2\}$

(B) $\{0,\ -1,\ -2\}$

(C) $\{-2,\ -1,\ 0,\ 1,\ 2\}$

(D) None of these

Q2: NTA Test 02 (Single Choice)

In a certain town 25% families own a cell phone, 15% families own a scooter and 65% families own neither a cell phone nor a scooter. If 1500 families own both a cell phone and a scooter, then the total number of families in the town is

(A) 10000

(B) 20000

(C) 30000

(D) 40000

Q3: NTA Test 03 (Single Choice)

If A is the set of even natural numbers less than 8 and B is the set of prime numbers less than 7, then the number of relations from A to B are

(A) 2^9

(B) 9^2

(C) 3^2

(D) 2^{9-1}

Q4: NTA Test 04 (Single Choice)

The relation "less than" in the set of natural numbers is

(A) only symmetric

(B) only transitive

(C) only reflexive

(D) an equivalence relation

Q5: NTA Test 05 (Single Choice)

The relation R is defined in the set $\{1,\ 2,\ 3,\ 4,\ 5,\ 6\}$ as $R = \{(a, b) : b = a + 1\}$, then

(A) R is neither reflexive nor symmetric nor transitive

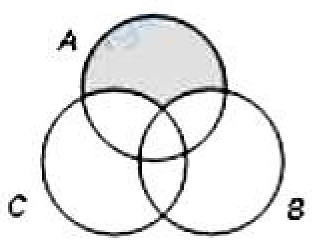
(B) R is neither reflexive nor symmetric but transitive

(C) R is not reflexive but symmetric and transitive

(D) R is reflexive, symmetric and transitive

Q6: NTA Test 06 (Single Choice)

The shaded region in the given figure represents



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

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

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

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

Q7: NTA Test 07 (Single Choice)

A relation R is defined from $\{2,\ 3,\ 4,\ 5\}$ to $\{3,\ 6,\ 7,\ 10\}$ by x R y $\Rightarrow$ x is relatively prime to y, then domain of R is

(A) $\{2,\ 3,\ 5\}$

(B) $\{3,\ 5\}$

(C) $\{2,\ 3,\ 4\}$

(D) $\{2,\ 3,\ 4,\ 5\}$

Q8: NTA Test 08 (Single Choice)

If $A = \{x : x^2 - 5x + 6 = 0\},\ B = \{2, 4\},\ C = \{4, 5\}$, then $A \times (B \cap C)$ is

(A) $\{(2,\ 4),\ (3,\ 4)\}$

(B) $\{(4,\ 2),\ (4,\ 3)\}$

(C) $\{(2,\ 4),\ (3,\ 4),\ (4,\ 4)\}$

(D) $\{(2,\ 2),\ (3,\ 3),\ (4,\ 4),\ (5,\ 5)\}$

Q9: NTA Test 11 (Single Choice)

Let P be the relation defined on the set of all real numbers such that $P = \left\{(a, b) : \sec^2 a - \tan^2 b = 1\right\}$. Then P is

(A) reflexive and symmetric but not transitive
(B) symmetric and transitive but not reflexive
(C) reflexive and transitive but not symmetric
(D) an equivalence relation

Q10: NTA Test 12 (Numerical)

The number of elements in the set $\left\{(a, b) : a^2 + b^2 = 50;\ a,\ b \in Z\right\}$, where Z is the set of all integers, is

Q11: NTA Test 13 (Single Choice)

Let W denotes the words in the English dictionary. If the relation R is given by

$R = \{(x,\ y) \in W \times W :$ the word x and y have at least one letter in common$\}$, then R is

(A) reflexive, symmetric and not transitive
(B) reflexive, symmetric and transitive
(C) reflexive, not symmetric and transitive
(D) not reflexive, symmetric and transitive

Q12: NTA Test 14 (Single Choice)

Let S be the set of all real numbers. Then, the relation $R = \{(a,\ b) : 1 + ab > 0\}$ on S is

(A) reflexive and symmetric but not transitive
(B) reflexive and transitive but not symmetric
(C) reflexive, transitive and symmetric
(D) None of the above

Q13: NTA Test 15 (Single Choice)

If $A = \{x \in R : |x| < 2\}$ and $B = \{x \in R : |x - 2| \geq 3\}$; then

(A) $A \cap B = (-2,\ -1)$
(B) $B - A = R - (-2, 5)$
(C) $A \cup B = R - (2, 5)$
(D) $A - B = [-1, 2)$

Q14: NTA Test 16 (Single Choice)

If relations R_1 and R_2 from set A to set B are defined as $R_1 = \{(1, 2),\ (3, 4),\ (5, 6)\}$ and $R_2 = \{(2, 1),\ (4, 3),\ (6, 5)\}$, then $n(A \times B)$ can be equal to

(A) 35
(B) 53
(C) 91
(D) 55

Q15: NTA Test 17 (Single Choice)

If $A = \{x : x = 6^n - 5n - 1, n \in N\}$ and $B = \{x : x = 25(n - 1), n \in N\}$, then

(A) $A = B$
(B) $B \subset A$
(C) $A \subseteq B$
(D) $B \subseteq A$

Q16: NTA Test 18 (Single Choice)

If A & B are two sets such that $n(A \times B) = 60$ & $n(A) = 12$ also $n(A \cap B) = K$, then the sum of maximum & minimum possible value of K is

(A) 17
(B) 12
(C) 5
(D) 7

Q17: NTA Test 19 (Single Choice)

If the difference between the number of subsets of two sets A and B is 120, then $n(A \times B)$ is equal to

(A) 21
(B) 25

(C) 18

(D) 24

Q18: NTA Test 20 (Single Choice)

If the difference between the number of subsets of the sets A and B is 120, then choose the incorrect option.

(A) Maximum value of $n\left(A\cap B\right)=3$

(B) Minimum value of $n\left(A\cap B\right)=0$

(C) Maximum value of $n\left(A\cup B\right)=21$

(D) Minimum value of $n\left(A\cup B\right)=7$

Q19: NTA Test 27 (Single Choice)

Let Z be the set of integers, if $A=\left\{x\in Z:\ |x-3|^{\left(x^2-5x+6\right)}=1\right\}$ and $B=\{x\in Z:\ 10<3x+1<22\}$, then the number of subsets of the set $A\times B$ is

(A) 2^6

(B) 2^8

(C) 2^{15}

(D) 2^9

Q20: NTA Test 33 (Single Choice)

If set $A=\{x:\ \tan x=\sec x,\ x\in[0,4\pi]\}$ and set $B=\left\{x:\ \sin^2 x=1,\ x\in[0,4\pi]\right\}$, then

(A) $B\subset A$

(B) $A=B$

(C) $A\cap B=B$

(D) $n\left(A\times B\right)=0$

Q21: NTA Test 36 (Single Choice)

The relation R given by $\left\{(x,y):\ x^2-3xy+2y^2=0,\ \forall x,y\in R\right\}$ is

(A) reflexive but not symmetric

(B) symmetric but not transitive

(C) symmetric and transitive

(D) an equivalence relation

Q22: NTA Test 39 (Single Choice)

Let A and B be two sets. The set A has 2016 more subsets than B. If $A\cap B$ has 3 members, then the number of members in $A\cup B$ is

(A) 10

(B) 11

(C) 12

(D) 13

Q23: NTA Test 45 (Single Choice)

If in a class there are 200 students in which 120 take Mathematics, 90 take Physics, 60 take Chemistry, 50 take Mathematics & Physics, 50 take Mathematics & Chemistry, 43 take Physics & Chemistry and 38 take Mathematics, Physics & Chemistry, then the number of students who have taken exactly one subject is

(A) 42

(B) 56

(C) 270

(D) 98

Answer Keys

Q1: (C) **Q2:** (C) **Q3:** (A)

Q4: (B) **Q5:** (A) **Q6:** (D)

Q7: (D) **Q8:** (A) **Q9:** (D)

Q10: 12 **Q11:** (A) **Q12:** (A)

Q13: (B) **Q14:** (C) **Q15:** (C)

Q16: (C) **Q17:** (A) **Q18:** (C)

Q19: (A) **Q20:** (D) **Q21:** (A)

Q22: (D) **Q23:** (D)

Solutions

Q1: (C) $\{-2, \ -1, 0, 1, 2\}$

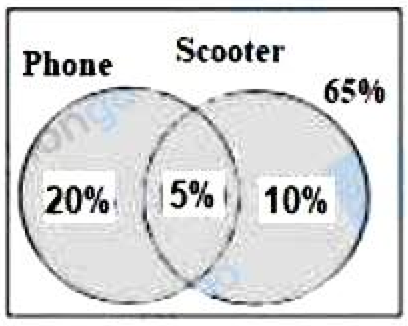
$\because R = \{(x, y)|x, y \in Z, x^2 + y^2 \leq 4\}$

$R = \{(-2, 0), (-1, 0), (0, \ -1), (-1, 1), (1, \ -1), (0, \ -1) (0, 1), (0, 2), (0, -2), (1, 0), (0, 1), (1, 1), (-1, \ -1), (2, 0), (0, 0)\}$

Hence, Domain of $R = \{-2, \ -1, 0, 1, 2\}$

Q2: (C) 30000

Let the total population of town be x.



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

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

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

$\Rightarrow \quad x = 30000$

Q3: (A) 2^9

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

$\therefore A \times \ B$ contains $3 \times 3 = 9$ elements.

Hence, the number of relations from A to $B = 2^9$.

Q4: (B) only transitive
Since, $x < y, \ y < z \Rightarrow x < z \forall x, \ y, \ z \in N$

$\therefore x \ R \ y, \ yR \ z \Rightarrow x \ R \ z,$

$\therefore$ Relation is transitive,

$\because x < y$ does not give $y < x$,

$\therefore$ Relation is not symmetric.

Since, $x < x$ does not hold, hence the relation is not reflexive.

Q5: (A) R is neither reflexive nor symmetric nor transitive

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

The relation R is defined on set A is

$R = \{(a,\ b)\ :\ b = a + 1\}$. Therefore, $R = \{(1,\ 2),\ (2,\ 3),\ (3,\ 4),\ (4,\ 5),\ (5,\ 6)\}$

Now, $6\ \in\ A$ but $(6,\ 6)\ \notin\ R$.

Therefore, R is not reflexive.

It can be observed that $(1,\ 2)\ \in\ R$ but $(2, 1)\ \notin R$. Therefore, R is not symmetric.

Now, $(1,\ 2),\ (2,\ 3)\ \in\ R$ but $(1,\ 3) \notin\ R$. Therefore, R is not transitive.

Hence, R is neither reflexive nor symmetric nor transitive

Q6: (D) $A - (B \cup C)$

Shaded region contain elements of A not in B & not in C hence it is $A - (B \cup C)$

Q7: (D) $\{2,\ 3,\ 4,\ 5\}$

Given, x R y $\Rightarrow$ x is relatively prime to y.

$R = \{(2,\ 3),\ \ (2,\ 7),\ \ (3, 7),\ \ (3, 10),\ \ (4,\ 3),\ \ (4,\ 7),\ \ (5,\ 3),\ \ (5,\ 6),\ \ (5,\ 7)\}$

$\therefore$ Domain of R $= \{2,\ 3,\ 4,\ 5\}$

Q8: (A) $\{(2,\ 4),\ \ (3,\ 4)\}$

Clearly, $A\ =\ \{2,\ 3\},\ B =\ \{2,\ 4\},\ C =\ \{4,\ 5\}$

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

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

Q9: (D) an equivalence relation

$\mathrm{P} = \left\{(\mathrm{a}, \mathrm{b}) : \sec^2 \mathrm{a} - \tan^2 \mathrm{b} = 1\right\}$

$\sec^2 \mathrm{a} - \tan^2 \mathrm{b} = 1$

$\Rightarrow \sec^2 \mathrm{a} = 1 + \tan^2 \mathrm{b}$

$\Rightarrow \sec^2 \mathrm{a} = \sec^2 \mathrm{b}$

$\Rightarrow |\sec \mathrm{a}| = |\sec \mathrm{b}|$

$\sec^2 \mathrm{a} - \tan^2 \mathrm{b} = 1$

$1 + \tan^2 \mathrm{a} - \sec^2 \mathrm{b} + 1 = 1$

$\sec^2 b - \tan^2 a = 1$

Hence, it is Symmetric.

If $|\sec a| = |\sec b|$ and $|\sec b| = |\sec c|$ then $|\sec a| = |\sec c| \Rightarrow$ transitive

So it is an equivalence relation.

Q10: 12

$a^2 + b^2 = 50$
$a = 1 \Rightarrow b^2 = 49$
$\Rightarrow b = \pm 7$
$a = 2, 3, 4, 6$ do not give integer value of b .
$a = 5 \Rightarrow b^2 = 25 \Rightarrow b = \pm 5$
$a = 7 \Rightarrow b^2 = 1$
$\Rightarrow b = \pm 1$
Similarly,
$a = -1 \Rightarrow b = \pm 7$
$a = -5 \Rightarrow b = \pm 5$
$a = -7 \rightarrow b = \pm 1$
$\Rightarrow$ The required number of elements $(a, b) = 12$

Q11: (A) reflexive, symmetric and not transitive

Given, $R = \{(x, y) \in W \times W$: the word x and y have atleast one letter in common$\}$

Let, $W = \{\text{cat}, \ \text{toy}, \ \text{you}, \ldots\}$

Clearly, R is reflexive and symmetric but not transitive.

[Since, cat R toy, toy R you $\nRightarrow$ cat R you]

Q12: (A) reflexive and symmetric but not transitive

$R = \{(a, \ b) : 1 + ab > 0\}$
(i) $(1, 1) \in R$

(ii) $(1, 2) \in R \ \Rightarrow (2, 1) \in R$

(iii) $(1, 2) \in R$ and $(2, 3) \in R \Rightarrow (1, 3) \in R$
It is clear that the given relation on S is reflexive, symmetric but not transitive.

Q13: (B) $B - A = R - (-2, 5)$
$A = \{x : x \in (-2,2)\}$
$B = \{x : x \in (-\infty, -1] \cup [5, \ \infty)\}$
$A \cap B = \{x : x \in (-2, -1]\}$
$A \cup B = \{x : x \in (-\infty, 2) \cup [5, \infty)\}$
$A - B = \{x : x \in (-1,2)\}$
$B - A = \{x : x \in (-\infty, \ -2] \cup [5, \ \infty)\}$

Q14: (C) 91

$n(A \times B) = n(A) \times n(B)$
Now minimum $n(A) = 6$ and minimum $n(B) = 6$
$\Rightarrow n(A) \times n(B)$ can be equal to $7 \times 13 = 91$

Q15: (C) $A \subseteq B$

A = {0, 25, 200, ...}

B = {0, 25, 50, 75 ......}
Clearly, $A \subseteq B$

Q16: (C) 5

$n(B) = \frac{n(A \times B)}{n(A)} = 5$
$\therefore n(A \cap B)$ has minimum value $= 0$
and $n(A \cap B)$ has maximum value $= n(B) = 5$

Q17: (A) 21

Let, $n(A) = \alpha$ & $n(B) = \beta$
Given, $|2^\alpha - 2^\beta| = 120 \Rightarrow (\alpha, \beta) \equiv (7,3), (3,7)$
$\therefore n(A \times B) = 7 \times 3 = 21$

Q18: (C) Maximum value of $n(A \cup B) = 21$

Let, $n(A) = \alpha, n(B) = \beta\,(\alpha > \beta)$
given, $2^\alpha - 2^\beta = 120 \Rightarrow \alpha = 7, \beta = 3$
$\therefore n(A \cap B) \in [0, 3] \because n(A \cup B) = \alpha + \beta = n(A \cap B)$
$n(A \cup B) \in [7, 10]$

Q19: (A) 2^6

For A,

$|x - 3| = 1 \Rightarrow x = 2{,}4$ or
$x^2 - 5x + 6 = 0 \Rightarrow x = 2{,}3$ but $x \neq 3$
$\therefore A = \{2{,}4\}$

For B,

$B = \{4\ ,5, 6\}$
$n(A \times B) = 6$

$\therefore$ number of subsets $= 2^6$

Q20: (D) $n(A \times B) = 0$

For A, $\frac{\sin x}{\cos x} = \frac{1}{\cos x} \Rightarrow \sin x = 1$
$\therefore\ x = \frac{\pi}{2}, \frac{5\pi}{2}$
but at $x = \frac{\pi}{2}, \frac{5\pi}{2}$

$\tan x, \ \sec\theta$ is not defined
$\therefore \ A = \phi$
for $B, \ \sin x = 1, \ \sin x = -1$
$x = \frac{\pi}{2}, \frac{5\pi}{2}$ or $x = \frac{3\pi}{2}, \frac{7\pi}{2}$
$\therefore B = \left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}\right\}$
$\therefore n\left(A \times B\right) = 0$

Q21: (A) reflexive but not symmetric

$\because \ x^2 - 3xy + 2y^2 = 0$
$\Rightarrow x^2 - xy - 2xy + 2y^2 = 0$
$\Rightarrow x\left(x - y\right) - 2y\left(x - y\right) = 0$
$\Rightarrow \left(x - 2y\right)\left(x - y\right) = 0$
$\Rightarrow x = y$ or $x = 2y$
Now, $\because$ in R all ordered pairs (x, x) are present
$\therefore$ It is reflexive
Now, $(4, 2) \in R$ as $4 = 2\left(2\right)$
but $(2,4) \notin R$ as $2 \neq 2\left(4\right)$
$\therefore$ It is not symmetric
Also $(4,2)$ & $(2,1) \in R$ but $(4,1) \notin R$
$\therefore$ It is not transitive

Q22: (D) 13

If A has m members and B has n members, then
$2^{\mathrm{m}} - 2^{\mathrm{n}} = 2016 = 2^5 . 63$
$\Rightarrow 2^{\mathrm{n}}\left(2^{\mathrm{m}-\mathrm{n}} - 1\right) = 2^5\left(64 - 1\right) = 2^5\left(2^6 - 1\right)$
$\Rightarrow \mathrm{n} = 5$ and $\mathrm{m} - \mathrm{n} = 6 \Rightarrow \mathrm{m} = 11$
The number of members in $\mathrm{A} \cup \mathrm{B}$
$= 11 + 5 - 3 = 13$

Q23: (D) 98

Let, $M \rightarrow$Mathematics, $P \rightarrow$Physics, $C \rightarrow$Chemistry
Given that total students $= 200$
$n\left(M\right) = 120, n\left(P\right) = 90, \ n\left(C\right) = 60$
$n\left(M \cap P\right) = 50, n\left(M \cap C\right) = 50, \ n\left(P \cap C\right) = 43$
$n\left(M \cap P \cap C\right) = 38$
Required number of students taking exactly one subject is
$n\left(M\right) + n\left(P\right) + n\left(C\right) - 2n\left(M \cap P\right) - 2n\left(P \cap C\right) - 2n\left(M \cap C\right) + 3n\left(M \cap P \cap C\right)$
$= 120 + 90 + 60 - 2\left(50\right) - 2\left(50\right) - 2\left(43\right) + 3\left(38\right)$
$= 98$