EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. If R is a relation from a finite set A having m elements to a finite set B having n elements, then the number of relations from A to B is-

(A) 2^{mn-1} (B) $2^{mn}-1$ (C) 2^{mn} (D) m^n

MRL001

2. Let R be a relation from the set {1, 2, 3.....,30} to itself such that $R = \{(a, b) : b = pq$, where $p, q \geq 3$ are prime numbers}. Then, the number of elements in R is :

(A) 110 (B) 120 (C) 130 (D) 140

MRL003

3. Let R_1 and R_2 be relations on the set {1, 2, ..., 7} such that $R_1 = \{(p, p^n) : p$ is a prime and $n \geq 0$ is an integer} and $R_2 = \{(p, p^n) : p$ is a prime and $n = 0$ or 1}. Then, the number of elements in $R_1 - R_2$ is ____.

(A) 0 (B) 1 (C) 2 (D) 4

MRL004

4. Let R = {(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)} be relation on the set A = {3, 6, 9, 12). The relation is-

(A) reflexive and transitive only (B) reflexive only

(C) an equivalence relation (D) reflexive and symmetric only

MRL006

5. Let L denote the set of all straight lines in a plane. Let a relation R be defined by $\alpha\ R\ \beta \Leftrightarrow \alpha \perp \beta$, $\alpha, \beta \in L$. Then R is-

(A) Reflexive (B) Symmetric (C) Transitive (D) none of these

MRL007

6. The relation R defined on the set A = {1, 2, 3, 4, 5} by $R = \{(x, y) : |x^2 - y^2| < 16\}$ is given by

(A) {(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)} (B) {(2, 2), (3, 2), (4, 2), (2, 4)}

(C) {(3, 3), (3, 4), (5, 4), (4, 3), (3, 1)} (D) None of these

MRL042

7. Let $R = \{(x, y) : x, y \in A, x + y = 5\}$, where A = {1, 2, 3, 4, 5}, then

(A) R is not reflexive, symmetric and not transitive

(B) R is an equivalence relation

(C) R is reflexive, symmetric but not transitive

(D) R is not reflexive, not symmetric but transitive

MRL010

8. In the set $A = \{1, 2, 3, 4, 5\}$ a relation R is defined by $R = \{(x, y) | x, y \in A$ and $x < y\}$. Then R is

(A) Reflexive (B) Symmetric (C) Transitive (D) Equivalence relation

MRL011

9. The relation R defined in N as $aRb \Leftrightarrow b$ is divisible by a is

(A) Reflexive but not symmetric (B) Symmetric but not transitive

(C) Symmetric and transitive (D) Equivalence relation

MRL012

10. Which one of the following relations on R is equivalence relation-

(A) $xR_1y \Leftrightarrow x^2 = y^2$ (B) $xR_2y \Leftrightarrow x \geq y$

(C) $xR_3y \Leftrightarrow x|y(x \text{ divides } y)$ (D) $xR_4y \Leftrightarrow x < y$

MRL013

11. 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, transitive but not symmetric

(C) Symmetric, transitive but not reflexive

(D) Reflexive, transitive and symmetric

MRL015

12. **Statement–1 :** In the set $N \times N$ consider relation R defined as $(a, b)\ R\ (c, d) \Rightarrow ad = bc$; then R is equivalence relation.

Statement–2 : Relation R is reflexive, symmetric & transitive.

(A) Statement–1 is true, Statement–2 is true; Statement–2 is not the correct explanation of Statement–1

(B) Statement–1 is false, Statement–2 is true

(C) Statement–1 is true, Statement–2 is false

(D) Statement–1 is true, Statement–2 is true; Statement–2 is the correct explanation of Statement–1.

MRL016

13. Let R and S be two equivalence relations in a set A. Then-

(A) $R \cup S$ is an equivalence relation in A (B) $R \cap S$ is an equivalence relation in A

(C) $R - S$ is an equivalence relation in A (D) none of these

MRL017

14. Let $A = \{p, q, r\}$. Which of the following is an equivalence relation in A ?

(A) $R_1 = \{(p, q), (q, r), (p, r), (p, p)\}$ (B) $R_2 = \{(r, q)\ (r, p), (r, r), (q, q)\}$

(C) $R_3 = \{(p, p), (q, q), (r, r), (p, q)\}$ (D) none of these

MRL018

15. Let W denote the words in the English dictionary. Define the relation R by : $R = \{(x, y) \in W \times W$: the words 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

MRL020

EXERCISE - S

1. A and B are two sets having 3 and 4 elements respectively and having 2 elements in common. If the number of relations which can be defined from A to B is 4^n then value of n -

MRL022

2. The relation R defined in $A = \{1, 2, 3\}$ by a R b if $|a^2 - b^2| \leq 5$. Number of elements in range of R

MRL023

3. Let $A = \{2, 3, 4, 5, \ldots, 16\}$ and $'\simeq'$ be an equivalence relation on $A \times A$, defined by $(a, b) \simeq (c, d)$, if and only if $ad = bc$. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair (4, 3) is equal to :

MRL024

4. Given the relation $R = \{(1, 2), (2, 3)\}$ on the set $A = \{1, 2, 3\}$, the minimum number of ordered pairs which when added to R make it an equivalence relation is -

MRL025

5. Let $A=\{0, 3,4,6,7,8,9,10\}$ and R be the relation defined on A such that $R=\{(x,y)\in A\times A: x-y$ is odd positive integer or $x - y = 2\}$. The minimum number of elements that must be added to the relation R, so that it is a symmetric relation, is equal to ____.

MRL043

6. Let $A = \{2, 3, 4\}$ and $B = \{8, 9, 12\}$. Then the number of elements in the relation $R = \{((a_1, b_1), (a_2, b_2)) \in (A \times B, A \times B): a_1$ divides b_2 and a_2 divides $b_1\}$ is :

MRL044

7. Let A= {–4, –3, –2, 0, 1, 3, 4} and $R = \{(a, b) \in A \times A: b = |a|$ or $b^2 = a + 1\}$ be a relation on A. Then the minimum number of elements, that must be added to the relation R so that it becomes reflexive and symmetric, is____.

MRL045

8. The minimum number of elements that must be added to the relation $R = \{(a, b), (b, c), (b, d)\}$ on the set $\{a, b, c, d\}$ so that it is an equivalence relation, is _____.

MRL046

9. Let $A=\sum_{i=1}^{10}\sum_{j=1}^{10}\min\{i, j\}$ and $B=\sum_{i=1}^{10}\sum_{j=1}^{10}\max\{i, j\}$. Then $A + B$ is equal to _____.

MRL047

10. Let $A = \{1, 2, 3, 4\}$ and R be a relation on the set $A \times A$ defined by $R=\{((a,b),(c,d)):2a+3b=4c+5d\}$. Then the number of elements in R is:

MRL048

EXERCISE - (JEE-Main) PYQS

1. Let Z be the set of integers. If $A = \{x \in Z : 2^{(x+2)(x^2-5x+6)} = 1\}$ and $B = \{x \in Z : -3 < 2x - 1 < 9\}$, then the number of subsets of the set $A \times B$, is: **[JEE (Main) 2019]**

(1) 2^{18} (2) 2^{10} (3) 2^{15} (4) 2^{12}

MRL026

2. If $R = \{(x, y) : x, y \in Z, x^2 + 3y^2 \le 8\}$ is a relation on the set of integers Z, then the domain of R^{-1} is: **[JEE (Main) 2020]**

(1) {–2, –1, 1,2} (2) {–1, 0, 1} (3) {–2, –1, 0, 1, 2} (4) {0, 1}

MRL027

3. Let R_1 and R_2 be two relations defined as follows :
$R_1 = \{(a, b) \in R^2 : a^2 + b^2 \in Q\}$ and $R_2 = \{(a, b) \in R^2 : a^2 + b^2 \notin Q\}$,
where Q is the set of all rational numbers. Then: **[JEE (Main) 2021]**

(1) R_2 is transitive but R_1 is not transitive (2) R_1 is transitive but R_2 is not transitive
(3) R_1 and R_2 are both transitive (4) Neither R_1 nor R_2 is transitive

MRL028

4. Let $A = \{2, 3, 4, 5, \ldots, 30\}$ and $'\simeq'$ be an equivalence relation on $A \times A$, defined by $(a, b) \simeq (c, d)$, if and only if $ad = bc$. Then the number of ordered pairs which satisfy this equivalence relation with ordered pair (4, 3) is equal to : **[JEE (Main) 2021]**

(1) 5 (2) 6 (3) 8 (4) 7

MRL029

5. Let R_1 and R_2 be two relations defined on $\mathbb{R}$ by $a\ R_1\ b \Leftrightarrow ab \ge 0$ and $a\ R_2 b \Leftrightarrow a \ge b$, then **[JEE (Main) 2022]**

(1) R_1 is an equivalence relation but not R_2 (2) R_2 is an equivalence relation but not R_1
(3) both R_1 and R_2 are equivalence relations (4) neither R_1 nor R_2 is an equivalence relation

MRL030

6. For $\alpha \in N$, consider a relation R on N given by $R = \{(x, y) : 3x + \alpha y$ is a multiple of 7$\}$. The relation R is an equivalence relation if and only if : **[JEE (Main) 2022]**

(1) $\alpha = 14$
(2) α is a multiple of 4
(3) 4 is the remainder when α is divided by 10
(4) 4 is the remainder when α is divided by 7

MRL031

7. Let R be a relation from the set {1, 2, 3.....,60} to itself such that $R = \{(a, b) : b = pq$, where $p, q \ge 3$ are prime numbers$\}$. Then, the number of elements in R is : **[JEE (Main) 2022]**

(1) 600 (2) 660 (3) 540 (4) 720

MRL032

8. Let $R_1 = \{(a,b) \in N \times N : |a-b| \le 13\}$ and $R_2 = \{(a,b) \in N \times N : |a-b| \ne 13\}$. Then on N: **[JEE (Main) 2022]**

(1) Both R_1 and R_2 are equivalence relations (2) Neither R_1 nor R_2 is an equivalence relation
(3) R_1 is an equivalence relation but R_2 is not (4) R_2 is an equivalence relation but R_1 is not

MRL033

9. Let R_1 and R_2 be relations on the set {1, 2, ..., 50} such that $R_1 = \{(p, p^n) : p$ is a prime and $n \geq 0$ is an integer} and $R_2 = \{(p, p^n) : p$ is a prime and $n = 0$ or 1. Then, the number of elements in $R_1 - R_2$ is. **[JEE (Main) 2022]**

MRL034

10. Let a set $A = A_1 \cup A_2 \cup ... \cup A_k$, where $A_i \cap A_j = \phi$ for $i \neq j$ $1 \leq i, j \leq k$. Define the relation R from A to A by $R = \{(x, y) : y \in A_i$ if and only if $x \in A_i, 1 \leq i \leq k\}$. Then, R is : **[JEE (Main) 2022]**

(1) reflexive, symmetric but not transitive (2) reflexive, transitive but not symmetric

(3) reflexive but not symmetric and transitive (4) an equivalence relation

MRL035

11. Let R be a relation on $\mathbb{R}$, given by $R = \{(a, b) : 3a - 3b + \sqrt{7}$ is an irrational number}. Then R is **[JEE (Main) 2023]**

(1) Reflexive but neither symmetric nor transitive

(2) Reflexive and transitive but not symmetric

(3) Reflexive and symmetric but not transitive

(4) An equivalence relation

MRL036

12. Let $P(S)$ denote the power set of $S = \{1,2,3,\ldots,10\}$. Define the relations R_1 and R_2 on $P(S)$ as AR_1B if $(A \cap B^c) \cup (B \cap A^c) = \varnothing$ and AR_2B if $A \cup B^c = B \cup A^c$, $\forall$ $A, B \in P(S)$. Then : **[JEE (Main) 2023]**

(1) both R_1 and R_2 are equivalence relations (2) only R_1 is an equivalence relation

(3) only R_2 is an equivalence relation (4) both R_1 and R_2 are not equivalence relations

MRL037

13. Among the relations $S = \left\{(a,b) : a,b \in \mathbb{R} - \{0\}, 2 + \frac{a}{b} > 0\right\}$ And $T = \{(a,b) : a,b \in \mathbb{R}, a^2 - b^2 \in Z\}$,

[JEE (Main) 2023]

(1) S is transitive but T is not (2) T is symmetric but S is not

(3) Neither S nor T is transitive (4) Both S and T are symmetric

MRL038

14. Let $A = \{1, 3, 4, 6, 9\}$ and $B = \{2, 4, 5, 8, 10\}$. Let R be a relation defined on $A \times B$ such that $R = \{((a_1, b_1), (a_2, b_2)) : a_1 \leq b_2$ and $b_1 \leq a_2\}$. Then the number of elements in the set R is

[JEE (Main) 2023]

(1) 26 (2) 160 (3) 180 (4) 52

MRL039

15. The relation $R = \left\{(a,b) : \gcd(a,b) = 1, 2a \neq b, a,b \in \mathbb{Z}\right\}$ is: ___

[JEE (Main) 2023]

(1) transitive but not reflexive (2) symmetric but not transitive

(3) reflexive but not symmetric (4) neither symmetric nor transitive

MRL040

16. Let A = {1, 2, 3, 4, 5, 6, 7}.Then the relation $R = \{(x, y) \in A \times A : x + y = 7\}$is **[JEE (Main) 2023]**

(1) transitive but neither symmetric nor reflexive

(2) reflexive but neither symmetric nor transitive

(3) an equivalence relation

(4) symmetric but neither reflexive nor transitive

MRL041

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	C	B	B	A	B	D	A	C	A	A
Que.	11	12	13	14	15					
Ans.	A	D	B	D	A					

EXERCISE - S

1. 6 **2.** 3 **3.** 4 **4.** 7 **5.** 19

6. 36 **7.** 7 **8.** 13 **9.** 1100 **10.** 6

EXERCISE - (JEE-Main) PYQS

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	3	2	4	4	4	4	2	2	8	4
Que.	11	12	13	14	15	16				
Ans.	1	1	2	2	4	4				