JEE MAIN + ADVANCED

MATHEMATICS

TOPIC NAME

SET

&

RELATIONS

(PRACTICE SHEET)

LEVEL- 1

Question based on **Sets**

Q.1 Which of the following statements is true for sets -
(A) a collection of well defined objects
(B) a collection of objects
(C) a collection of well defined objects which are distinct and distinguishable
(D) All of the above

Q.2 The set $\{x : x \in N, x \text{ is prime and } 3 < x < 5\}$ is-
(A) $\{4\}$ (B) $\{3, 5\}$
(C) Void (D) Non – Void

Q.3 $A = \{a, e, i, o, u\}$ and $B = \{i, o\}$ then the true statement is-
(A) $A \subset B$ (B) $B \subset A$
(C) $A = B$ (D) A is equivalent B

Q.4 A set is defined as $A = \{x : x \text{ is irrational and } 0.1 < x < 0.101\}$ then :
(A) A is null set (B) A is finite set
(C) A is infinite set (D) none

Q.5 Which of the following is a singleton Set -
(A) ϕ (B) $\{\ \}$
(C) $\{2, 3\}$ (D) $\{\phi\}$

Q.6 If $A = \{\phi, \{\phi\}\}$, then the power set of A is -
(A) A (B) $\{\phi, \{\phi\}, A\}$
(C) $\{\phi, \{\phi\}, \{\{\phi\}\}, A\}$ (D) none of these

Q.7 If $A = \{x|x^2 = 4\}$ and $B = \{x|\ x^2 - 5x + 6 = 0\}$ then $A \cup B$
(A) $\{2, 3\}$ (B) $\{-2, 3\}$
(C) $\{2, -3\}$ (D) $\{-2, 2, 3\}$

Q.8 Given the sets $A = \{1, 2, 3\}$, $B = \{3, 4\}$, $C = \{4, 5, 6\}$, then $A \cup (B \cap C)$ is -
(A) $\{3\}$ (B) $\{1, 2, 3, 4\}$
(C) $\{1, 2, 4, 5\}$ (D) $\{1, 2, 3, 4, 5, 6\}$

Q.9 If $N_a = \{a\,n : n \in N\}$, then $N_6 \cap N_8 =$
(A) N_6 (B) N_8 (C) N_{24} (D) N_{44}

Q.10 Which of the following is the empty set ?
(A) $\{x : x \in R \text{ and } x^2 + x + 1 = 0\}$
(B) $\{x : x \in R \text{ and } x^2 - x + 1 = 0\}$
(C) $\{x : x \in R \text{ and } x^2 + 2x + 1 \le 0\}$
(D) $\{x : x \in R \text{ and } x^2 - 2x + 1 \ge 0\}$

Q.11 Two finite sets have m and n elements respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are -
(A) 7, 6 (B) 6, 3
(C) 5, 1 (D) 8, 7

Q.12 If $A = \{x \mid x/2 \in Z, 0 \le x \le 10\}$,
$B = \{x \mid x \text{ is one digit prime}\}$
$C = \{x \mid x/3 \in N, x \le 12\}$,
Then $A \cap (B \cup C)$ is equal to-
(A) $\{2, 6\}$ (B) $\{3, 6, 12\}$
(C) $\{2, 6, 12\}$ (D) $\{6, 8\}$

Q.13 If $n(A) = 10$, $n(B) = 15$ and $n(A \cup B) = x$, then -
(A) $15 < x < 25$ (B) $15 \le x \le 25$
(C) $5 \le x \le 15$ (D) None of these

Q.14 Among 1000 families of a city, 40% read newspaper A, 20% read newspaper B, 10% read newspaper C, 5% read both A and B, 3% read both B and C, 4% read A and C and 2% read all three newspapers. The number of families which read only newspaper A is-
(A) 140 (B) 290
(C) 330 (D) 340

Q.15 If for three disjoint sets A, B, C; $n(A) = 10$, $n(B) = 6$ and $n(C) = 5$, then $n(A \cup B \cup C)$ is equal to-
(A) 21 (B) 11 (C) 1 (D) 9

Q.16 If A and B are disjoint, then $n(A \cup B)$ is equal to-
(A) $n(A)$ (B) $n(B)$
(C) $n(A) + n(B)$ (D) $n(A).n(B)$

Q.17 If X and Y are two sets, then $X \cap (Y \cup X)^c$ equals-
(A) X (B) Y
(C) ϕ (D) none of these

Q.18 Let $n(U) = 700$, $n(A) = 200$, $n(B) = 300$ and $n(A \cap B) = 100$, then $n(A^c \cap B^c)$ is -
(A) 400 (B) 600
(C) 300 (D) 200

Q.19 The set $(A \cap B^c)^c \cup (B \cap C)$ is equal to -
(A) $A \cup B \cup C$ (B) $A^c \cup B$
(C) $A^c \cup B^c$ (D) none

Q.20 Sets A and B have 3 and 6 elements respectively. What can be the minimum number of elements in $A \cup B$?
(A) 3 (B) 6 (C) 9 (D) 18

Q.21 In a class of 100 students, 55 students have passed in Mathematics and 67 students have passed in Physics, no student fails. Then the number of students who have passed in Physics only is-
(A) 22 (B) 33 (C) 10 (D) 45

Q.22 Let $X = \{1, 2, 3, 4, 5, 6\}$ be a universal set. Sets A, B, C in the universal set X be defined by $A = \{1, 2, 3\}$, $B = \{2, 4, 5\}$ & $C = \{3, 4, 5, 6\}$. Then-

(A) $A - B = \{4, 5\}$
(B) $(A - B) \cup (B - A) = \{1, 3, 4, 5\}$
(C) $(A - B) - C = \{1\}$
(D) $A \cap C' = \{1, 2\}$

Q.23 If A, B and C are any three sets, then $A \times (B \cup C)$ is-

(A) $(A \times B) \cup (A \times C)$
(B) $(A \cup B) \times (A \cup C)$
(C) $(A \times B) \cap (A \times C)$
(D) None of these

Q.24 If A, B and C are any three sets, then $A \times (B \cap C)$ is -

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

Q.25 Let $A = \{a, b, c, d\}$, $B = \{b, c, d, e\}$. Then $n[(A \times B) \cap (B \times A)]$ is equal to -

(A) 3 (B) 6
(C) 9 (D) none

Question based on **Relation**

Q.26 In the set $A = \{1, 2, 3, 4, 5\}$, a relation R is defined by $R = \{(x, y) \mid x, y \in A \text{ and } x < y\}$. Then R is -

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

Q.27 Let R be a relation on the set N of natural numbers defined by $nRm \Leftrightarrow n$ is a factor of m (i.e. $n \mid m$). Then R is -

(A) Reflexive and symmetric
(B) Transitive and symmetric
(C) Equivalence
(D) Reflexive, transitive but not symmetric

Q.28 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} (B) $2^{mn} - 1$
(C) 2mn (D) m^n

Q.29 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

Q.30 Two points A and B in a plane are related if OA = OB, where O is a fixed point. This relation is -

(A) Reflexive but not symmetric
(B) Symmetric but not transitive
(C) An equivalence relation
(D) None of these

Q.31 The relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ on the set $A = \{1, 2, 3\}$ is -

(A) Reflexive but not symmetric
(B) Reflexive but not transitive
(C) Symmetric and transitive
(D) Neither symmetric nor transitive

Q.32 Let $A = \{2, 3, 4, 5\}$ and let $R = \{(2, 2), (3, 3), (4, 4), (5, 5), (2, 3), (3, 2), (3, 5), (5, 3)\}$ be a relation on A. Then R is -

(A) Reflexive and transitive
(B) Reflexive and symmetric
(C) An equivalence relation
(D) None of these

Q.33 Let L be the set of all straight lines in the xy-plane. Two lines ℓ_1 and ℓ_2 are said to be related by the relation R if ℓ_1 is parallel to ℓ_2. Then the relation R is -

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

Q.34 Given the relation $R = \{(2, 3), (3, 4)\}$ on the set $\{2, 3, 4\}$. The number of minimum number of ordered pairs to be added to R so that R is reflexive and symmetric –

(A) 4 (B) 5
(C) 7 (D) 6

Q.35 The minimum number of elements that must be added to the relation $R = \{(1, 2), (2, 3)\}$ on the set $\{1, 2, 3\}$, so that it is equivalence is-

(A) 4 (B) 7
(C) 6 (D) 5

Q.36 Let a relation 'R' is define on 'Z' set of integers such that $a R b \Rightarrow a$ is divisible by b then 'R' is-

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

Q.37 Let $R : \Delta \to \Delta$, where Δ is set of all triangles such that $\Delta_1 R \Delta_2 \Rightarrow \Delta_1$ is congruent to Δ_2 then 'R' is-

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

Q.38 Let $R : A \to A$, A is set of all children in a family such that $xRy \Rightarrow x$ is brother of 'y' (where $x, y \in A$), then R is-

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

LEVEL- 2

SECTION –A

Q.1 Let $A = \{1, 2, 3, 4\}$, and let $R = \{(2, 2), (3, 3), (4, 4), (1, 2)\}$ be a relation on A. Then R is-
(A) Reflexive (B) Symmetric
(C) Transitive (D) None of these

Q.2 The void relation on a set A is-
(A) Reflexive
(B) Symmetric and transitive
(C) Reflexive and symmetric
(D) Reflexive and transitive

Q.3 For real numbers x and y, we write
$xRy \Leftrightarrow x - y + \sqrt{2}$ is an irrational number. Then the relation R is -
(A) Reflexive (B) Symmetric
(C) Transitive (D) None of these

Q.4 Let $X = \{1, 2, 3, 4, 5\}$ and $Y = \{1, 3, 5, 7, 9\}$. Which of the following is/are relations from X to Y-
(A) $R_1 = \{(x, y) \mid y = 2 + x, x \in X, y \in Y\}$
(B) $R_2 = \{(1, 1), (2, 1), (3, 3), (4, 3), (5, 5)\}$
(C) $R_3 = \{(1, 1), (1, 3), (3, 5), (3, 7), (5, 7)\}$
(D) $R_4 = \{(1, 3), (2, 5), (2, 4), (7, 9)\}$

Q.5 Let R be a relation defined in the set of real numbers by $aRb \Leftrightarrow 1 + ab > 0$. Then R is-
(A) Equivalence relation
(B) Transitive
(C) Symmetric
(D) Anti-symmetric

Q.6 Which one of the following relations on R is equivalence relation-
(A) $xR_1y \Leftrightarrow |x| = |y|$ (B) $xR_2y \Leftrightarrow x \geq y$
(C) $xR_3y \Leftrightarrow x \mid y$ (D) $xR_4y \Leftrightarrow x < y$

Q.7 Let R be a relation in N defined by
$R = \{(1+ x, 1+ x^2): x \leq 5, x \in N\}$.
Which of the following is false -
(A) $R = \{(2, 2), (3, 5), (4, 10), (5, 17), (6, 25)\}$
(B) Domain of $R = \{2, 3, 4, 5, 6\}$
(C) Range of $R = \{2, 5, 10, 17, 26\}$
(D) None of these

Q.8 The relation R defined in $A = \{1, 2, 3\}$ by aRb if $|a^2 - b^2| \leq 5$.
Which of the following is false
(A) $R = \{(1, 1), (2, 2), (3, 3), (2, 1), (1, 2), (2, 3), (3, 2)\}$
(B) $R^{-1} = R$
(C) Domain of $R = \{1, 2, 3\}$
(D) Range of $R = \{5\}$

Q.9 The relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ on the set $A = \{1, 2, 3\}$ is -
(A) Reflexive but not symmetric
(B) Reflexive but not transitive
(C) Symmetric and transitive
(D) Neither symmetric nor transitive

Q.10 Let a relation R in the set N of natural numbers be defined as $(x, y) \in R$ if and only if $x^2 - 4xy + 3y^2 = 0$ for all $x, y \in N$. The relation R is -
(A) Reflexive (B) Symmetric
(C) Transitive (D) An equivalence relation

Q.11 Let $A = \{2, 3, 4, 5\}$ and let
$R = \{(2, 2), (3, 3), (4, 4), (5, 5), (2, 3), (3, 2), (3, 5), (5, 3)\}$ be a relation in A. Then R is -
(A) Reflexive and transitive
(B) Reflexive and symmetric
(C) Reflexive and antisymmetric
(D) None of these

Q.12 If $A = \{2, 3\}$ and $B = \{1, 2\}$, then $A \times B =$
(A) $\{(2, 1), (2, 2), (3, 1), (3, 2)\}$
(B) $\{(1, 2), (1, 3), (2, 2), (2, 3)\}$
(C) $\{(2, 1), (3, 2)\}$
(D) $\{(1, 2), (2, 3)\}$

Q.13 Let N denote the set of all natural numbers and R be the relation on $N \times N$ defined by $(a, b) R (c, d)$ if $ad(b + c) = bc(a + d)$, then R is-
(A) Symmetric only
(B) Reflexive only
(C) Transitive only
(D) An equivalence relation

Q.14 If $A = \{1, 2, 3\}$, $B = \{1, 4, 6, 9\}$ and R is a relation from A to B defined by 'x is greater than y'. The range of R is -

(A) $\{1, 4, 6, 9\}$ (B) $\{4, 6, 9\}$

(C) $\{1\}$ (D) None of these

Q.15 Let $R = \{(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)\}$ be a relation on the set $A = \{1, 2, 3, 4\}$. The relation R is - **[AIEEE-2004]**

(A) transitive (B) not symmetric

(C) reflexive (D) a function

Q.16 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 - **[AIEEE-2005]**

(A) reflexive and transitive only

(B) reflexive only

(C) an equivalence relation

(D) reflexive and symmetric only

Q.17 Let W denote the words in the English dictionary. Define the relation Rby : $R = \{(x, y) \in W \times W \mid$ the words x and y have at least one letter in common$\}$. Then R is – **[AIEEE 2006]**

(A) reflexive, symmetric and not transitive

(B) reflexive, symmetric and transitive

(C) reflexive, not symmetric and transitive

(D) not reflexive, symmetric and transitive

Q.18 Let R be the real line. Consider the following subsets of the plane R × R :

$S = \{(x, y): y = x + 1 \text{ and } 0 < x < 2\}$

$T = \{(x, y) : x - y \text{ is an integer}\}$.

Which one of the following is true ? **[AIEEE 2008]**

(A) Both S and T are equivalence relations on R

(B) S is an equivalence relation on R but T is not

(C) T is an equivalence relation on R but S is not

(D) Neither S nor T is an equivalence relation on R

Q.19 If A, B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then - **[AIEEE 2009]**

(A) A = B (B) A = C

(C) B = C (D) $A \cap B = \phi$

Q.20 Let R be the set of real numbers.

Statement-1:

$A = \{(x, y) \in R \times R : y - x \text{ is an integer}\}$ is an equivalence relation on R.

Statement-2:

$B = \{(x, y) \in R \times R : x = \alpha y \text{ for some rational number } \alpha\}$ is an equivalence relation on R. **[AIEEE 2011]**

(A) Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false.

(D) Statement-1 is false, Statement-2 is true.

Q.21 Let $P = \{\theta : \sin\theta - \cos\theta = \sqrt{2}\cos\theta\}$ and $Q = \{\theta : \sin\theta + \cos\theta = \sqrt{2}\sin\theta\}$ be two sets. Then **[IIT 2011]**

(A) $P \subset Q$ and $Q - P \neq \varnothing$

(B) $Q \not\subset P$

(C) $P \not\subset Q$

(D) P = Q

ANSWER KEY

LEVEL- 1

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	C	C	B	C	D	C	D	B	C	A,B	B	A	B	C	A	C	C	C	B	B
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
Ans.	D	B,C,D	A	B	C	C	D	A	B	C	A	B	D	B	B	C	D	C		

LEVEL- 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	C	B	A	A,B,C	C	A	A	D	A	A	B	A	D	C	B	A	A	C	C	C

21.[D] P : $\sin\theta - \cos\theta = \sqrt{2}\cos\theta$

$\sin\theta = (\sqrt{2}+1)\cos\theta$

$\tan\theta = \sqrt{2}+1$

$\tan\theta = \tan 67\frac{1}{2}^{\circ}$

$\theta = n\pi + \frac{3\pi}{8}, n\in I$

Q: $\sin\theta + \cos\theta = \sqrt{2}\sin\theta$

$\cos\theta = (\sqrt{2}-1)\sin\theta$

$\tan\theta = \sqrt{2}+1$

$\theta = n\pi + \frac{3\pi}{8}, n \in I$

$\therefore$ P = Q