MATHS

BOOKS - OBJECTIVE RD SHARMA ENGLISH

CARTESIAN PRODUCT OF SETS AND RELATIONS

Illustration

1. If A = {1, 2} and B = {0, 1}, then A $\times$ B =

A. {(1, 0), (1, 1), (2, 0), (2, 1)}

B. {(1, 0), (2, 1)}

C. {(1, 1), (1, 2), (0, 1), (0, 2)}

D. none of these

Answer: A

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2. If A = {1, 2, 3}, B = {3, 4, 5}, then $(A \cap B) \times A$ is

A. $\{(1, 3), (2, 3), (3, 3)\}$

B. $\{(3, 1), (3, 2), (3, 3)\}$

C. $\{(1, 3), (3, 1), (3, 2)\}$

D. none of these

Answer: B

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3. If A = $\{x \in R : 0 < x < 1\}$ and $B = \{y \in R : -1 < y < 1\}$, then $A \times B$ is the set of all points lying

A. inside the rectangle having vertices at (1, 1), (0, 1), (0, -1) and (1, -1)

B. inside the rectangle having vertices at (1, 0), (1, 1), (0, 1) and (0, 0)

C. on the sides of the rectangle whose vertices are at (1, 1), (0, 1), (0, -1) and (1, -1)

D. inside or on the sides of the rectangle whose vertices are at (1, 1), (0, 1), (0, -1) and (1, -1)

Answer: A

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4. If A = {a, b, c, d} and B = {1, 2, 3}, then which of the following is not a relation from A to B?

A. $R_1 = \{(a, 1), (2, b), (c, 3)\}$

B. $R_2 = \{(a, 1), (d, 3), (b, 2), (b, 3)\}$

C. $R_3 = \{(1, a), (2, b), (3, c)\}$

D. $R_4 = \{(a, 1), (b, 2), (c, 3), (3, d)\}$

Answer: B

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5. Let $A = \{1, 2, 3, \ldots 10\}$ and $R = \{(x, y) : x + 2y = 10, x, y \in A\}$ be a relation A. Then, $R^{-1} =$

A. $\{(2, 4), (4, 3), (6, 2), (8, 1)\}$

B. $\{(4, 2), (3, 4), (2, 6), (1, 8)\}$

C. $\{(4, 2), (3, 4), (2, 6)\}$

D. $\{(y, x) : 2x + y = 10, x, y \in A\}$

Answer: B

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6. Which of the following relations is not symmetric?

A. R_1 on R defined by $(x, y) \in R_1 \Leftrightarrow 1 + xy > 0$ for all $x, y \in R$

B. R_2 on $N \times N$ defined by

$(a, b)R_2(c, d) \Leftrightarrow a + d = b + c$ for all $a, b, c, d \in N$

C. R_3 on Z defined by $(a, b) \in R_3 \Leftrightarrow b - a$ is an even integer

D. R_4 on power set of a set X defined by A R_4 B iff $A \subseteq B$.

Answer: D

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7. Which one of the following is not an equivalence relation?

A. R_1 on Z defined by a $R_1 b \Leftrightarrow a - b$ is divisible by m, where m is a fixed positive integer.

B. R_2 on R defined by a $R_2 b \Leftrightarrow 1 + ab > 0$ for all $a, b \in R$.

C. R_3 on $N \times N$ defined by (a, b) R_3 (c, d) $\Leftrightarrow$ ad = bc for all a, b, c, d $\in$ N.

D. R_4 on Z defined by aR_4 b $\Leftrightarrow$ a-b is an even integer for all $a, b \in Z$.

Answer: B

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Section I Solved Mcqs

1. Let A and B be two sets such that

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

Then,

A. A = {1, 2, 3} and B = {a, b}

B. A = {a, b} and B = {1, 2, 3}

C. A = {1, 2, 3} and $B \subset \{a, b\}$

D. $A \subset \{a, b\}$ and $B \subset \{1, 2, 3\}$

Answer: B

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2. Let A and B be two sets such that $A \times B$ consists of 6 elements. If three elements of $A \times B$ are: $(1, 4),\ (2, 6),\ (3, 6)$. Find $A\ and\ B$.

A. A = {1, 2} and B = {3, 4, 6}

B. A = {4, 6} and B = {1, 2, 3}

C. A = {1, 2, 3} and B = {4, 6}

D. A = {1, 2, 4} and B = {3, 6}

Answer: C

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3. The Cartesian product $A \times A$ has 9 elements among which are found $(1,\ \ 0)\ \ and\ \ (0,\ \ 1)$. Find the set A and the remaining elements of $A \times A$.

A. A = {-1, 0}

B. A = {0, 1}

C. A = {-1, 0, 1}

D. A = {-1, 1}

Answer: C

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4. A and B are two non empty set having n element in common ; then prove that $A \times B$ and $B \times A$ have n^2 element in common.

A. 2n

B. n

C. n^2

D. none of these

Answer: C

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5. If $AandB$ are two sets having 3 elements in common. If $n(A)=5, n(B)=4,$ find $n(A\times B)andn[(A\times B)\cap(B\times A)].$

A. 20

B. 16

C. 3

D. 9

Answer: D

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6. For any three sets A, B, C prove that:

$A\times\left(B'\cup C'\right)'=(A\times B)\cap(A\times C)$

$A\times\left(B'\cap C'\right)'=(A\times B)\cup(A\times C)$

A. $(A\times B)\cap(A\times C)$

B. $(A\times B)\cup(B\times C)$

C. $(A \times C) \cap (B \times C)$

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

Answer: A

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7. about to only mathematics

A. {3, 4, 5}

B. {0, 3, 4, 5}

C. $\{0, \pm 3, \pm 4, \pm 5\}$

D. none of these

Answer: C

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8. R is a relation on the set Z of integers and it is given by $(x, y) \in R \Leftrightarrow |x - y| \leq 1$. Then, R is (a) reflexive and transitive (b) reflexive and symmetric (c) symmetric and transitive (d) an equivalence relation

A. reflexive and transitive

B. reflexive and symmetric

C. symmetric and transitive

D. an equivalence relation

Answer: B

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9. S is a relation over the set R of all real numbers and it is given by $(a, b) \in S \Leftrightarrow ab \geq 0$. Then, S is symmetric and transitive only reflexive and symmetric only (c) antisymmetric relation (d) an equivalence relation

A. symmetric and transitive only

B. reflexive and symmetric only

C. a partial order relation

D. an equivalence relation

Answer: D

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10. The relation R defined on the set A = {1, 2, 3, 4, 5} by

$R = \{(a, b) : |a^2 - b^2| < 16\}$ is given by

A. $\{(1, 1), (2, 1), (3, 1), (4, 1), (2, 3)\}$

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

C. $\{(3, 3), (4, 3), (5, 4), (3, 4)\}$

D. none of these

Answer: D

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11. Let R be the relation over the set of all straight lines in a plane such that $l_1 \, R \, l_2 \Leftrightarrow l_1 \perp l_2$. Then, R is (a) symmetric (b) reflexive (c) transitive (d) an equivalence relation

A. symmetric

B. reflexive

C. transitive

D. an equivalence relation

Answer: A

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12. If $A = \{a, \ b, \ c\}$, then the relation $R = \{(b, \ c)\}$ on A is (a) reflexive only (b) symmetric only (c) transitive only (d) reflexive and transitive only

A. reflexive only

B. symmetric only

C. transitive only

D. reflexive and transitive only

Answer: C

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13. In the set Z of all integers, which of the following relation R is not an equivalence relation? $x\ R\ y$: if $x \leq y$ (b) $x\ R\ y$: if $x = y$ (c) $x\ R\ y$: if $x - y$ is an even integer (d) $x\ R\ y$: if $x = y$ (mod 3)

A. xRy: if $x \leq y$

B. xRy: if $x = y$

C. xRy: if $x - y$ is an even integer

D. xRy: if $x = y$ (mod 3)

Answer: A

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14. Theorem 1(i) (For any three set $A; B; C;$ prove that $A \times (B \cup C) = (A \times B) \cup (A \times C))$

A. $(A \times B) \cup (A \times C)$

B. $(A \cup B) \times (A \cup C)$

C. both (a) and (b)

D. none of these

Answer: A

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

A. {(2, 4), (3, 4)}

B. {(4, 2), (4, 3)}

C. {(2, 4), (3, 4), (4, 4)}

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

Answer: A

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16. If $A = \{a, b\}, B = \{c, d\}, C = \{d, e\},$ then $\{(a, c), (a, d), (a, e), (b, c), (b, d), (b, e)\}$ is equal to

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

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

C. $A \times (B \cup C)$

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

Answer: C

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17. If R is a relation on the set $A = \{1, 2, 3\}$ given by $R = \{(1, 1), (2, 2), (3, 3)\}$, then R is

A. symmetric only

B. reflexive only

C. an equivalence relation

D. transitive only

Answer: C

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18. The relation R defined on the set $A = \{1, 2, 3, 4, 5\}$ by $R = \{(a, b) : |a^2 - b^2| < 16\}$, is given by {(1, 1), (2, 1), (3, 1), (4, 1), (2, 3) {(2, 2), (3, 2), (4, 2), (2, 4)} {(3, 3), (4, 3), (5, 4), (3, 4) (d) none of these

A. reflexive

B. transitive

C. not symmetric

D. a function

Answer: C

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19. Let Y={1,2,3,4,5}, A={1,2}, B={3,4,5}. If $(A \times B)$ denotes Cartesian product of the set A and B. then the number of elements in $(Y \times A) \cap (Y \times B)$ is.....

A. Y

B. A

C. B

D. ϕ

Answer: D

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20. Let $A = \{2, 3, 4, 5, \ldots\ldots 17, 18\}$. Let $''$ be the equivalence relation on $A \times A$, cartesian product of A with itself, defined by $(a, b)(c, d)$ iff $ad = bc$. Then, the number of ordered pairs of the equivalence class of (3, 2) is (a) 4 (b) 5 (c) 6 (d) 7

A. 4

B. 5

C. 6

D. 7

Answer: C

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21. 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. Symmetric and transitive but not reflexive

D. None of the above is true

Answer: A

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22. 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 symmetric only

B. an equivalence relation

C. reflexive only

D. reflexive and transitive only

Answer: D

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23. Let R be the real line. Consider the following subsets of the plane $R \times R$. $S = \{(x, y) : y = x + 1 and 0 < x < 2\}, T = \{(x, y) : x - y$ is an integer $\}$. Which one of the following is true?

A. S is an equivalence relation on R but T is not

B. T is an equivalence relation on R but S is not

C. Neither S not T is an equivalence relation on R

D. Both S and T are equivalence relation on R

Answer: B

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24. Let w denotes the set of 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. not reflexive, symmetric and transitive

B. reflexive, symmetric and not transitive

C. reflexive, not symmetric and transitive

D. reflexive, symmetric and transitive.

Answer: B

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25. On the set N of natural numbers, delined the relation F by a R b if the GCD of a and b is 2, then R is

A. reflexive but not symmetric

B. symmetric only

C. equivalence

D. neither reflexive, nor transitive.

Answer: B

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26. The relation R defined on the set $A = \{1, 2, 3, 4, 5\}$ by $R = \{(a, b) : |a^2 - b^2| < 16\}$, is given by {(1, 1), (2, 1), (3, 1), (4, 1), (2, 3) {(2, 2), (3, 2), (4, 2), (2, 4)} {(3, 3), (4, 3), (5, 4), (3, 4) (d) none of these

A. a function

B. transitive

C. not symmetric

D. reflexive

Answer: C

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27. The relation on the set $A = \{x|x| < 3, x, \in Z\}$ is defined by $R = \{(x, y); y = |x|, x \neq -1\}$, Then the numbers of elements in the power set of R is

A. 32

B. 16

C. 8

D. 64

Answer: B

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28. The number of equivalence relations defined in the set S = {a, b, c} is

A. 3

B. 5

C. 7

D. 8

Answer: B

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29. Let R be a relation on the set of integers given by $aRb \Leftrightarrow a = 2^k.\, b$ for some integer k. Then, R is

A. an equivalence relation

B. reflexive but not symmetric

C. reflexive and transitive but not symmetric

D. reflexive and symmetric but not transitive.

Answer: A

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30. Consider the following relations:

$R = \{(x, y) \mid (x, y \text{ are real numbers and } x = wy \text{ for some rational numb}$

$S = \left\{ \left(\frac{m}{n}, \frac{p}{q} \right) m, n, p, \text{ and } q \text{ are integers such that } n, q \neq 0 \text{ and } qm = \pm \right\}$. Then

A. S is an equivalence relation but R is not an equivalence relation

B. R and S both are equivalence relations

C. R is an equivalence relation but S is not an equivalence relation

D. neither R nor S is an equivalence relation

Answer: A

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31. Let N be the set of natural numbers and for $a \in N$, aN denotes the set $\{ax : x \in N\}$. If $bN \cap cN = dN$, where b, c, d are natural numbers greater than 1 and the greatest common divisor (GCD) of b and c is 1, then d equals

A. $b + c$

B. $\{bc\}$

C. $\min\{b, c\}$

D. bc

Answer: D

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32. Let A and B be two sets containing four and two elements, respectively. Then, the number of subjects of the set $A \times B$, each having atleast three elements is

A. 275

B. 510

C. 219

D. 256

Answer: C

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33. If the numbers of different reflexive relations on a set A is equal to the number of different symmetric relations on set A, then the number of elements in A is

A. 1

B. 3

C. 1 and 3

D. 3 and 7

Answer: B

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34. Let $R = \{(x, y) : x, y \in N \text{ and } x^2 - 4xy + 3y^2 = 0\}$, where N is the set of all natural numbers. Then the relation R is

A. reflexive and transitive

B. reflexive symmetric

C. symmetric and transitive

D. on equivalence relation

Answer: A

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Section Ii Assertion Reason Type

1. Statement-1: On the set Z of all odd integers relation R defined by $(a, b) \in R \Leftrightarrow a - b$ is even for all $a, b \in Z$ is an equivalence relation.

Statement-2: If a relation R on a set A is symmetric and transitive, then it is reflexive and hence an equivalence relation, because

$(a, b) \in R \Rightarrow (b, a) \in R \quad [\text{By symmetry}]$

$(a, b) \in R \text{ and } (b, a) \in R \Rightarrow (a, a) \in R \quad [\text{By transitivity}]$

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.

Answer: C

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2. N is the set of natural numbers. The relation R is defined on $N \times N$ as follows

$(a, b)R(c, d) \Leftrightarrow a + d = b + c$

Prove that R is an equivalence relation.

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.

Answer: B

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3. N is the set of natural numbers. The relation R is defined on $N \times N$ as follows

$(a, b)R(c, d) \Leftrightarrow a + d = b + c$

Prove that R is an equivalence relation.

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.

Answer: C

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4. Statement-1: If R is an equivalence relation on a set A, then R^{-1} is also an equivalence relation.

Statement-2: $R = R^{-1}$ iff R is a symmetric relation.

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.

Answer: B

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5. Let R be the set of real numbers.

Statement 1: $A = \{(x, y) \in R \times R : y - x$ is an integer$\}$ is an equivalence relation on R.

Statement 2: $B = \{x, y\} \in R \times R : x = \alpha y$ for some rational number $\alpha\}$ is an equivalence relation on R.

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.

Answer: C

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6. Consider the following relation R on the set of realsquare matrices of order 3. $R = \{(A, B) \mid A = P^{-1}BP$ for some invertible matrix P} Statement I R is an equivalence relation. Statement II For any two invertible 3×3 matrices M and $N, (MN)^{-1} = N^{-1}M^{-1}$

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.

Answer: A

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Exercise

1. If R is a relation from a set A to set B, then

A. $R = A \cup B$

B. $R = A \cap B$

C. $R \subseteq A \times B$

D. $R \subseteq B \times A$

Answer: C

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2. 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

Answer: A

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3. If R is a relation on a finite set having n elements, then the number of relations on A is 2^n b. 2^n ^ 2 c. n^2 d. n^n

A. 2^n

B. 2^{n^2}

C. n^2

D. n^n

Answer: B

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4. about to only mathematics

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: B

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5. Let R be a reflexive relation on a set A and I be the identity relation on

A. Then

A. $R \subset I$

B. $I \subset R$

C. $R = I$

D. none of these

Answer: B

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6. Let A be the non-void set of the children in a family. The relation 'x is a brother of y' on A, is

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: C

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7. Let O be the origin. We define a relation between two points P and Q in a plane if $OP = OQ$. Show that the relation, so defined is an equivalence relation.

A. partial order relation

B. equivalence relation

C. reflexive but not symmetric

D. reflexive but not transitive

Answer: B

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

A. reflexive but not symmetric

B. symmetric but not transitive

C. symmetric and transitive

D. none of these

Answer: A

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9. Given the relation $R = \{(1, 2), (2, 3)\}$ on the set $A = \{1, 2, 3\}$, add a minimum number of ordered pairs so that the enlarged relation is symmetric, transitive and reflexive.

A. 5

B. 6

C. 7

D. 8

Answer: C

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10. An integer m is said to be related to another integer n, if m is integral multiple of n. This relation in Z is reflexive, symmetric and transitive.

A. reflexive and symmetric

B. reflexive and transitive

C. symmetric and transitive

D. equivalence relation

Answer: B

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11. 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

Answer: C

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12. Let R_1 be a relation defined by

$R_1 = \{(a, b) \mid a > b, a, b \in R\}$. Then R_1 , is

A. an equivalence relation on R

B. transitive but not reflexive and symmetric

C. symmetric, transitive but nor reflexive

D. neither transitive nor reflexive but symmetric

Answer: B

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13. Let R be a reflexive relation on a finite set A having n elements and let there be m ordered pairs in R, then

A. $m \geq n$

B. $m \leq n$

C. $m = n$

D. none of these

Answer: A

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14. The void relation on a set A is

A. reflexive

B. symmetric and transitive

C. reflexive and symmetric

D. reflexive and transitive

Answer: B

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15. Let R be an equivalence relation on a finite set A having n elements. Then the number of ordered pairs in R is

A. less than n

B. greater than or equal to n

C. less than or equals to n

D. none of these

Answer: B

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16. The relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ on 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

Answer: A

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17. Let R and S be two equivalence relations on a set A Then : A. $R \cup S$ is an equvalence relation on A B. $R \cap S$ is an equirvalenee relation on A C. $R - S$ is an equivalence relation on A D. None of these

A. $R \cup S$ is an equivalence relation on A

B. $R \cap S$ is an equivalence relation on A

C. $R - S$ is an equivalence relation on A

D. none of these

Answer: B

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18. The relation is subset of on the power set $P(A)$ of a set A is

A. symmetric

B. anti-symmetric

C. equivalence relation

D. none of these

Answer: B

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19. Let $P = \{(x, y) \mid x^2 + y^2 = 1, x, y \in R\}$. Then, P is

A. reflexive

B. symmetric

C. transitive

D. antisymmetric

Answer: B

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20. Let $R = \{(a, a)\}$ be a relation on a set A.Then R is

A. symmetric

B. antisymmetric

C. symmetric and antisymmetric

D. neither symmetric nor antisymmetric

Answer: C

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21. Which one of the following relations on R is an equivalence relation?

A. $aR_1b \Leftrightarrow |a| = |b|$

B. $aR_2b \Leftrightarrow a > b$

C. $aR_3b \Leftrightarrow$ a divides b

D. $aR_4b \Leftrightarrow a < b$

Answer: A

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22. Let X be a family of sets and R be a relation on X defined by A is disjoint from B. Then, R, is

A. reflexive

B. symmetric

C. antisymmetric

D. transitive

Answer: B

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23. If R is an equivalence relation on a set A, then R^{-1} is

A. reflexive only

B. symmetric but not transitive

C. equivalence

D. none of these

Answer: C

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24. Let R and S be two non-void relations on a set A. Which of the following statement is false?

A. R and S are transitive implies $R \cup S$ is transitive

B. R and S are transitive implies $R \cap S$ is transitive

C. R and S are symmetric implies $R \cup S$ is symmetric

D. R and S are reflexive implies $R \cap S$ is reflexive

Answer: A

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25. If R be a relation $<$ from A = {1, 2, 3, 4} to B = {1, 3, 5}, i.e. (a,b) $\in R \Leftrightarrow a < b$, then ROR^{-1}, is

A. $\{(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)\}$

B. $\{(3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)\}$

C. $\{(3, 3), (3, 5), (5, 3), (5, 5)\}$

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

Answer: C

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26. If R is a relation from a set A to a set B and S is a relation from B to a set C, then the relation SoR a) is from A to C b) is from C to A c) does not exist d) None of these

A. is from A to C

B. is from C to A

C. does not exist

D. none of these

Answer: A

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27. If $R \subset A \times B$ and $S \subset B \times C$ be two relations, then $(SoR)^{-1} =$

A. $S^{-1}oR^{-1}$

B. $R^{-1}oS^{-1}$

C. SoR

D. RoS

Answer: B

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

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: C

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29. Let A = {p, q, r}. Which of the following is not an equivalence relation on 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

Answer: D

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30. In order that a relation R defined on a non-empty set A is an equivalence relation. It is sufficient, if R

A. is reflective

B. is symmetric

C. is transitive

D. possesses all the above three properties

Answer: D

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31. Let R be a relation on the set N of natural numbers defined by $n\ R\ m$ iff n divides m. Then, R is (a) Reflexive and symmetric (b) Transitive and symmetric (c) Equivalence (d) Reflexive, transitive but not symmetric

A. reflexive and symmetric

B. transitive and symmetric

C. equivalence

D. reflexive, transitive but not symmetric

Answer: D

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32. Let R and S be two non-void relations on a set A. Which of the following statement is false?

A. R and S are transitive, then $R \cup S$ is also transitive

B. R and S are transitive, then $R \cap S$ is also transitive

C. R and S are reflexive, then $R \cap S$ is also reflexive

D. R and S are symmetric, then $R \cup S$ is also symmetric

Answer: A

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33. Let R be a relation defined on the set of natural numbers N as $R = \{(x, y) : x, y \in N, 2x + y = 41\}$ Find the domain and range of R. Also, verify whether R is (i) reflexive, (ii) symmetric (iii) transitive.

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: D

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34. Let L be the set of all straight lines in the Euclidean plane. Two lines l_1 and l_2 are said to be related by the relation R iff l_1 is parallel to l_2. Then, check the relation is reflexive , symmetric or transitive

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: D

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35. For real numbers x and y, define $x\ R\ y$ iff $x - y + \sqrt{2}$ is an irrational number. Then the relation R is (a) reflexive (b) symmetric (c) transitive (d) none of these

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: A

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36. Let $X = \{1, 2, 3, 4\}$ and $Y = \{1, 3, 5, 7, 9\}$. Which of the following is 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. $R_4 = \{(1, 3), (2, 5), (2, 4), (7, 9)\}$

Answer: D

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37. Let n be a fixed positive integer. Define a relation R on Z as follows: $(a, b) \in R \Leftrightarrow a - b$ is divisible by n. Show that R is an equivalence relation on Z.

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: D

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

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: B

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Chapter Test

1. If $n(A \times B) = 45$, then $n(A)$ cannot be

A. 15

B. 17

C. 5

D. 9

Answer: B

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2. Set builder form of the relation

$R = \{(-2, -7), (-1, -4), (0, -1), (1, 2), (2, 5)\}$ is

A. $\{(a, b) : b = 2a - 3, a, b, \in Z\}$

B. $\{(x, y) : y = 3x - 1, x, y \in Z\}$

C. $\{(a, b) : b = 3a - 1, a, b \in N\}$

D. $\{(u, v) : v = 3u - 1, -2 \leq u < 3 \text{ and } u \in Z\}$

Answer: D

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3. If A = {(a, b, c, l, m, n}, then the maximum number of elements in any relation on A, is

A. 12

B. 16

C. 32

D. 36

Answer: D

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4. If A={1, 2, 3}, then the relation

$R = \{(1, 1), (2, 2), (3, 1), (1, 3)\}$, is

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer: B

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5. If relation R is defined as: aRb if "a is the father of b". Then, R is

A. reflexive

B. symmetric

C. transitive

D. none of these

Answer: D

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6. If $R = \{(a, b) : |a + b| = a + b\}$ is a relation defined on a set $\{-1, 0, 1\}$, then R is

A. reflexive

B. symmetric

C. anti symmetric

D. transitive

Answer: B

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7. A relation between two persons is defined as follows: aRb $\Leftrightarrow$ a and born in different months. Then, R is

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer: B

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8. Which of the following is an equivalence relation?

A. is father of

B. is less than

C. is congruent to

D. is an uncle of

Answer: C

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9. Consider the following statements:

(i) Every reflexive relation is antisymmetric

(ii) Every symmetric relation is antisymmetric.

Which one among (i) and (ii) is true?

A. (i) alone is true

B. (ii) alone is true

C. Both (i) and (ii) are true

D. Neither (i) nor (ii) is true

Answer: D

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10. Let A be a set of compartments in a train. Then the relation R defined on A as aRb iff "a and b have the link between them", then which of the following is true for R?

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer: B

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11. If a set has 13 elements and R is a reflexive relation on A with n elements, then

A. $13 \leq n \leq 26$

B. $0 \leq n \leq 26$

C. $13 \leq n \leq 169$

D. $0 < n \leq 169$

Answer: C

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12. The relation 'is not equal to' is defined on R, is

A. reflexive only

B. symmetric only

C. transitive only

D. equivalence.

Answer: B

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13. Assertion and Reason type questions :Consider the following statements, p: Every reflexive relation is a symmetric relation, q: Every anti-symmetric relation is reflexive.Which of the following is/ are true?

A. p alone

B. q alone

C. both q and q

D. neither p nor q

Answer: D

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14. Let X be the set of all engineering colleges in a state of Indian Republic and R be a relation on X defined as two colleges are related iff they are affiliated to the same university, then R is

A. only reflexive

B. only symmetric

C. only transitive

D. equivalence

Answer: D

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15. If $R = \{(a, b) : a + b = 4\}$ is a relation on N, then R is

A. reflexive

B. symmetric

C. antisymmetric

D. transitive

Answer: B

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16. If A is a non-empty set, then which of the following is $f\ a\ l\ s\ e\ ?$

p: There is at least one reflexive relation on A

q: There is at least one symmetric relation on A

A. p alone

B. q alone

C. both p and q

D. neither p nor q

Answer: D

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17. If A = {x, y, z}, then the relation

$R = \{(x, x), (y, y), (z, z), (z, x), (z, y)\}$, is

A. symmetric

B. antisymmetric

C. transitive

D. both (a) and (b)

Answer: D

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18. Assertion and Reason type questions :Consider the following statements, p: Every reflexive relation is a symmetric relation, q: Every anti-symmetric relation is reflexive.Which of the following is/ are true?

A. p alone

B. q alone

C. both p and q

D. neither p nor q

Answer: D

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19. The relation "is a factor of" on the set N of all natural number is not

A. reflexive

B. symmetric

C. antisymmetric

D. transitive

Answer: B

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20. The relation $R = \{(1, 3), (3, 5)\}$ is defined on the set with minimum number of elements of natural numbers. The minimum number of elements to be included in R so that R is an equivalence relation, is

A. 5

B. 6

C. 7

D. 8

Answer: A

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21. If a set A contains n elements, then which of the following cannot be the number of reflexive relations on the set A?

A. 2^n

B. 2^{n-1}

C. 2^{n^2-1}

D. 2^{n+1}

Answer: D

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22. If A={4, 6, 10, 12} and R is a relation defined on A as "two elements are related iff they have exactly one common factor other than 1". Then the relation R is

A. antisymmetric

B. only transitive

C. only symmetric

D. equivalence

Answer: C

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23. In a set of ants in a locality, two ants are said to be related iff they walk on a same straight line, then the relation is

A. reflexive and symmetric

B. symmetric and transitive

C. reflexive and transitive

D. equivalence

Answer: D

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24. Let R be a relation defined on S, the set of squares on a chess board such that xRy iff x and y share a common side. Then, which of the following is false for R?

A. Reflexive

B. symmetric

C. Transitive

D. All the above

Answer: C

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25. X is the set of all residents in a colony and R is a relation defined on X as follows:

"Two persons are related iff they speak the same language"

The relation R, is

A. only symmetric

B. only reflexive

C. both symmetric and reflexive but not transitive

D. equivalence

Answer: D

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26. Let A = {ONGC, BHEL, SAIL, GAIL, IOCL} and R be a relation defined as "two elements of A are related if they share exactly one letter". The relation R, is

A. anti-symmetric

B. only transitive

C. only symmetric

D. equivalence

Answer: C

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27. Let A be the set of all animals. A relation R is defined as "aRb iff a and b are in different zoological parks". Then R is

A. only reflexive

B. only symmetric

C. only transitive

D. equivalence

Answer: B

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28. Let S be a non-empty set of children in a family and R be a relation on S defined by a R b iff a is a brother of b then R is

A. only reflexive

B. only symmetric

C. only transitive

D. equivalence

Answer: D

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29. Let A be the set of all student in a school. A relation R is defined on A as follows:

"aRb iff a and b have the same teacher"

The relation R, is

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer: D

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30. If A and B are two sets such that $n(A \cap \overline{B}) = 9, n(\overline{A} \cap B) = 10$ and $n(A \cup B) = 24$, then $n(A \times B) =$

A. 105

B. 210

C. 70

D. none of these

Answer: B

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