MATHS

BOOKS - MCGROW HILL EDUCATION MATHS (HINGLISH)

SETS, RELATIONS AND FUNCTIONS

Solved Examples Concept Based Single Correct Answer Type Questions

1. Let A = $\{y : y \in R, y^2 = 25 \text{ and } 2y = 18\}$, then

A. $A = \phi$

B. $A = \{5, -5, 9\}$

C. $A = \{5, 9\}$

D. {9}

Answer: A

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2. Let A = $\{7n : n \in N\}$ and $B = \{2^{3n} - 1 : n \in N\}$, then

A. $A = \subseteq B$

B. $B \subseteq A$

C. $A = B$

D. $A \cup B = N$

Answer: B

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3. Suppose A and B are two sets such that $A \cap B = A$ and $A = B = \phi$, then

A. $A \subseteq B$

B. $B \subseteq A$

C. $A = B$

D. $A = B = \phi$

Answer: C

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4. $A - B = \phi$ iff

A. A = B

B. $A \subseteq B$

C. $B \subseteq A$

D. $A = B = \phi$

Answer: B

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5. Suppose A and B be two sets such that $A - B = B - A$, then

A. $A \cap B = \phi$

B. $A \cup B = \phi$

C. A=B

D. $A = B = \phi$

Answer: C

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6. For $k \in N$, let $N_k = \{km : m \in N\}$

Suppose $a, b \in N$ and $N_a \cap N_b = N_c$ for some $c \in N$, then

A. c=ab

B. c=a+b

C. c=hcf(a,b)

D. c=lem(a,b)

Answer: D

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7. Power set of the set $A = \{\phi, \{\phi\}\}$ is

A. $\{\phi, \{\phi\}, \{\phi, \{\phi\}\}$

B. $\{\phi, \{\phi\}, \{\{\phi\}\}, \{\phi, \{\phi\}\}$

C. $\{\{\phi\}, \{\phi, \{\phi\}\}$

D. $\{\phi, \{\phi\}, \{\{\phi\}\}$

Answer: B

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8. if A and B are two sets , then $A \cap (A \cup B)$ equals

A. ϕ

B. A

C. B

D. $A \cap B'$

Answer: A

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9. Suppose A and B are two sets given as follows:

$A = \{\{x, y) : x, y \in R \text{ and } y = 2e^x\}$

$B = \{(x, y) : x, y \in R \text{ and } y = 2x + 1\}$

A. $A \subseteq B$

B. $B \subseteq A$

C. $A \cap B = \phi$

D. $A \cap B = A$

Answer: C

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10. Let $A = \{x : x \in R \text{ and } x^2 - 5x + 4 \leq 0\}$ and $B = \{x : x \in R \text{ and } x^2 - 12x + 45 > 0\}$ then which of the following is not true?

A. $A \cap B = A$

B. $A \cup B = R$

C. $A \cap B = \phi$

D. $A \subseteq B$

Answer: C

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11. If $A = \left\{(x, y) : x, y \in R, y = \left(\frac{1}{7}\right)^x\right\}$ and $B = \{(x, y), x, y \in R, y = 7x\}$ then

A. $A \cap B = \phi$

B. $A \cap B$ is singleton

C. A = B

D. $A \cup B = R$

Answer: B

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12. Suppose A and 5 are two sub-sets of a universal set U, then which of the following is not equal to A- B

A. $A \cap B'$

B. $(A' \cap B)$

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

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

Answer: B

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13. Two finite sets A and B have m and n elements respectively. If the number of sub-sets of A is 224 more than the number of sub-sets of B, then m - n is equal to

A. 2

B. 3

C. 4

D. 5

Answer: B

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14. If a set A contain 9 elements and set B contains 5 elements, then which of the following is not true?

A. $n(A \cup B) \geq 9$

B. $n(A \cup B) \leq 14$

C. $n(a \cap B) \leq 5$

D. $n(A \cap B) \geq 9$

Answer: D

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15. In a class of 70 students, 50 students study HL Mathematics and 25 study SL Physics, if each student studies at least one of the two subjects, then number of students studying only SL Physics, is

A. 20

B. 15

C. 18

D. 22

Answer: A

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16. In a college hostel, there are 500 students. Each student reads exactly 4 magazines and each magazine is read by exactly 125 students, then number of magazines subscribed by the hostel, is

A. 25

B. 16

C. 64

D. 50

Answer: B

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17. Let A be a finie set containing n distinct elements. The number of relations that can be defined on A is

A. 2^n

B. 2^{2n}

C. 2^{n^2}

D. 2^{n^2-n}

Answer: C

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18. Let R be a relation defined on Q as follows:

$a, b \in Q, aRB$ if and only if

$|a-b| \leq 1$

Then which of the following is true?

A. R is reflexive and symmetric

B. R is reflexive and transitive

C. R is symmetric only

D. R is anti-symmetric only

Answer: A

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19. Let R be a relation defined on the set $Z \times Z$ as follows:

$(a, b), (c, d) \in Z \times Z$

$(a, b)R(c, d)$ if ony if a-d = b-c

Then R is

A. reflexive and symmetric only

B. symmetric only

C. symmetric and transitive but not reflexive

D. reflexive, symmetric and transitive.

Answer: B

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20. For any two real numbers a and b , we define aRb if and only if $\sin^2 a + \cos^2 b = 1$, the relation R is -

A. R is reflexive but neither symmetric nor transitive

B. R is both reflexive and symmetric but not transitive

C. R is an equivalence relation

D. R is transitive and symmetric but not reflexive

Answer: C

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21. On N, define a relation R as follows:

$a, b \in N$, aRb if a|b

Then which of the following is not true?

A. R is reflexive

B. R is symmetric

C. R is anti-symmetric

D. R is transitive

Answer: B

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22. Let L be the set of all lines in a plane and R be the relation in L defined as $R = \{(L_1, L_2) : L_1(\text{ is perpendicular to L})_2\}$. Show that R is symmetric but neither reflexive nor transitive.

A. R is reflexive

B. R is symmetric

C. R is transitive

D. R is anti-symmetric

Answer: B

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23. On C, the set of complex numbers, define a relation R as follows:

$z_1, z_2 \in C$, $z_1 R z_2$ if $z_1 \bar{z}_2 \geq 0$ then

A. R is reflexive, symmetric but not transitive

B. R is reflexive only

C. R is symmetric only

D. R is an equivalence relation

Answer: A

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24. Suppose,

$M = \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \mid a, b, c, d \in R \right\}$ and $I_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Define a relation - on M as follows:

A. ~symmetric only

B. ~symmetric and transitive

C. ~reflexive and symmetric

D. ~is an equivalence relation

Answer: A

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25. Suppose A is a non-empty set and R_1, R_2 are two equivalence relations on A, then, then $R_1 \cup R_2$

A. is always an equivalence relation

B. is never an equivalence relation

C. is an equivalence relation if either $R_1 \subseteq R_2$ or $R_2 \subseteq R_1$

D. $R_1 \subseteq R_2$ is not symmetric

Answer: C

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26. If $R = \{\{2, a), (3, c), (9, b), (7, a), (8, a), (1, d)\}$, then R^{-1} is equal to

A. {(a,2),(a,7),(a,8),(b,9),(c,3),(d,1)}

B. {(a,2),(b,9),(c,2),(d,1)}

C. {(a,7),(a,8),(c,2),(d,1)}

D. {(a,2),(b,9),(c,3),(d,1)}

Answer: A

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27. On $N^{\cdot} = N - \{1\}$, define a relation as follows:

$a, b \in N$, aRb if there exists $m \in N^{\cdot}$, such that m|a and m|b, Then

A. R is reflexive and symmetric only

B. R is symmetric and transitive only

C. R is anti-symmetric

D. R is an equivalence relation

Answer: A

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28. On Q, the set of rational numbers, define a relation R as follows:

aRb

If $a\cos 15^{\circ} + b\sin 15^{\circ}$ is an irrational number, then

A. domain of R is Q

B. domain of R is Q - Z

C. domain of R is Q - N

D. domain of R is Q - A where A is a singleton.

Answer: A

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29. On N, define a relation ~ as follows:

$a, b \in N$, a~b if $\gcd(a, b) = 2$

Then ~ is

A. reflexive but not symmetric

B. transitive but not reflexive

C. an equivalence relation

D. symmetric only

Answer: D

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30. Let A = {1,2,3}, B={a,b,c,d} and C={x,y,z,w}. Let

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

S ={(a,x),(b,y),(c,y),(d,z)}

Then S.R is equal to

A. $\{(1, x), (1, y), (3, z)\}$

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

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

D. ϕ

Answer: C

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31. If $f: R \to R$ be defined as $f(x) = 2x + |x|$, then $f(2x) + f(-x) - f(x)$ is equal to

A. 4x

B. $4(x + |x|)$

C. $4|x|$

D. 0

Answer: B

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32. Let $f: R \to R$ be defined by

$$f(x) = \frac{x}{x+1}, x \neq -1$$

If $a, b \in R$ and $ab \neq 0$, $f\left(\frac{a}{b}\right) + f\left(\frac{b}{a}\right)$ and $a + b \neq 0$ is equal to

A. 1

B. 0

C. $\frac{a-b}{a+b}$

D. $\frac{b-a}{b+a}$

Answer: A

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33. Let $f(x) = 5x^3 + 7x^2 + 7x + 5$, the for $x \neq 0$, $x^3 f\left(\frac{1}{x}\right)$ is equal to

A. $f(-x)$

B. $f(x)$

C. $\frac{1}{f(x)}$

D. $\frac{1}{f(-x)}$

Answer: B

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34. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$, then $f\left(\frac{2x}{1+x^2}\right)$ is equal to

A. $2f(x)$

B. $f(2x)$

C. $f(x^2)$

D. $f\left(2x^2\right)$

Answer: A

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35. If $f(x) = \frac{4^x}{4^x + 2}$, then $f(x) + f(1 - x)$ is equal to

A. 3

B. 4

C. 2

D. 1

Answer: D

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36. Let $f(x) = \frac{\alpha x}{x + 1}$ Then the value of α for which $f(f(x) = x$ is

A. 1

B. 0

C. -1

D. 2

Answer: C

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37. The domain of $f(x) = \sqrt{\frac{2-|x|}{|x|-1}}$ is

A. $[2, -1) \cup (1, 2]$

B. $[-2, 2]$

C. $(-1, 1)$

D. $(-\infty, -1) \cup (2, \infty)$

Answer: A

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38. The domain of

$$f(x) = \cos\left[\log_5\left(\frac{\sqrt{25 - x^2}}{3 - x}\right)\right]$$

A. $(-\infty, 3)$

B. $(3, 5)$

C. [3,5)

D. $R - (3, 5)$

Answer: B

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39. Let $f(x) = \sin\left(\log_3\left(x + \sqrt{x^2 + 1}\right)\right), x \in R$, then

A. f is an even function

B. f is an odd function

C. f is a periodic function

D. f is neither even nor odd functions

Answer: B

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40. Which of the following is an even function?

A. $f(x) = \cos\left[\log\left(x + \sqrt{x^2 + 1}\right)\right], x \in R$

B. $f(x) = \dfrac{a^x - a^{-x}}{a^x + a^{-x}}$, where $a > 0, a \neq 1, x \in R$

C. $f(x) = \log_5\left(\dfrac{1 + x}{1 - x}\right), -1 < x < 1$

D. $f(x) = x^3 + \sin x, x \in R$

Answer: A

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41. Domain of $f(x) = \sqrt{\log_{0.3}(x!)}$ is

A. $[0, 1]$

B. $\{0, 1\}$

C. $[0, \infty)$

D. {0,1,2,3.....}

Answer: B

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42. Let [x]= greatest integer $\leq x$ and $f(x) = \cos\left(\left[\pi^2\right]x\right) + \sin\left(\left[e^2\right]x\right)$ then $f(\pi/4)$ is equal to

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43. The range fo $f(x) = \sec\left(\frac{\pi}{3}\cos^2 x\right)$

A. $(0, \infty)$

B. $[1, \infty)$

C. $[1, 2)$

D. $[2, \infty)$

Answer: C

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44. Let $f: R \to R$ be defined by

$f(x) = |\sin 4x| + |\cos 4x|, x \in R$, Then period of f is

A. $\frac{\pi}{8}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. π

Answer: B

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45. Suppose, $f, g: R \to R$ be defined by $f(x) = ax + b, g(x) = cx + d$, where a,b,c,d $\in R$ and $ac \neq 0$, if $f(g(x)) = g(f(x)) \forall x \in R$, then

A. f(a)=g(c)

B. f(d) = g(b)

C. f(c) = g(d)

D. f(a) = g(d)

Answer: B

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Solved Examples Level 1 Single Correct Answer Type Questions

1. Suppose A , B and C are three sets such that $A \cup C = B \cup C$ and $A \cap C = B \cap C$, then

A. $A = B$

B. $A = B = \phi$

C. A = B = C

D. $A \cup B \subseteq C$

Answer: A

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2. Let A, B and C be three sub-sets of a universal set U. if $A\Delta C = B\Delta C$, then

A. A=B

B. $A \cap B \subseteq C$

C. $A \cup B \subseteq C$

D. $A \cap B \subseteq C'$ the complement of C.

Answer: A

View Text Solution

3. Suppose $a, b \in N$ and $A = \{ax + by, x, y \in Z \text{ and } ax + by \in N\}$

If $A = \{kx : x \in N\}$ for some $k \in N$, then

A. k=ab

B. k=a+b

C. k=1 cm (a,b)

D. k=hcf(a,b)

Answer: D

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4. Let A and B be two sub-sets of R x R, defined as follows:

$A = \left\{(a, b) : a, b \in R \text{ and } \tan^{-1} a + \cot^{-1} b = \frac{\pi}{2}\right\}$ and

$B = \{(a, b) : a, b \in R \text{ and } \sin^2 a + \cos^2 b = 1\}$, then

A. $A \cap B = \{\{a, a) : a \in R\}$

B. $A \cap B = \phi$

C. $A \cup B = R \times R$

D. $A \cup B = \{(a, a), a \in R\}$

Answer: A

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5. Let A and B be two sets, and P(A) denotes the power set of A, then which of the following is true?

A. $P(A) \cup P(B) = P(A \cup B)$

B. $P(A) \cup P(B) \subseteq P(A \cup B)$

C. $P(A) \cap P(B) \neq P(A \cap B)$

D. $P(A) \cup P(B) = P(A \cap B)$

Answer: B

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6. If A, B and C are three sets, then

$(A - B) \cap (B - C) \cap (C - A)$ is equal to:

A. $A \cap B \cap C$

B. $A' \cap B' \cap C'$

C. ϕ

D. $A \cap B' \cap C$

Answer: C

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7. Let P and Q be two sets defined as follows:

$P - \{z \subset C : (1 + i)z \geq 0\}$

$Q = \left\{z \in C, \frac{z}{1 + i} \geq 0\right\}$, then

A. P = Q

B. $P \subseteq Q, P \neq Q$

C. $Q \subseteq P, P \neq Q$

D. $P \neq Q$

Answer: D

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8. Let P and Q be two sets of real numbers defined as follows:

$P = \{\theta \in R : \sin\theta - \sqrt{3}\cos\theta = 2\cos\theta\}$

$Q = \{\theta \in R, \cos\theta + \sqrt{3}\sin\theta = 2\sin\theta\}$, thnen

A. P = Q

B. $P \cap Q = \phi$

C. $P \subseteq Q, P \neq Q$

D. $Q \subseteq P, Q \neq P$

Answer: A

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9. Let A and B be two sub-sets of C defined as follows:

$A = \{z \in C : (1+3i)z + (1-3i)\bar{z} = 10\}$ and $B = \{z \in C : |z| = 1\}$,

then

A. $A \cap B = \phi$

B. $A = B$

C. $A \cap B$ is a singleton

D. $A \cap B$ consits of exactly two points.

Answer: A

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10. On the set N of all natural numbers, define R as follows:

aRb if and only if $hcf(a, b) = 3$, Then

A. R is reflexive but not symmetric

B. R is symmetric only

C. R is transitive only

D. R is an equivalence relation

Answer: B

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11. Let N denotes the set of all natural numbers. On $N \times N$ define R as follows:

(a,b), (c,d) $\in N \times N$

$(a, b)R(c, d)$ if ad(b+c) = bc(a+d), then

A. R is reflexive and symmetric only

B. R is reflexive and transitive only

C. R is an equivalence relation

D. R is anti-symmetric

Answer: C

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12. Let W= set of all persons living in Delhi. Define a relation R on W as follows:

$a, b \in R, aRb$

if a and b have the same date of birth. Then which of the following is not true?

A. R is reflexive

B. R is symmetric

C. R is anti-symmetric

D. R is transitive

Answer: C

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13. Let W= set of all persons living in Warangl. Define R on Was follows:

$a, b \in W$, aRb if the difference between their heights is 2 cm. Then

A. R is reflexive only

B. R is symmetric only

C. R is symmetric and transitive only

D. R is an equivalence relation

Answer: B

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14. On Z, the set of integers, define a relation R on Z as follows:

aRb if $ab \geq 0$, Then

A. R is reflexive and symmetric only

B. R is symmetric and transitive only

C. R is reflexive and transitive only

D. R is an equivalence relation

Answer: A

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15. Let $S = [1, \infty)$ define a relation ~ as $a, b \in S$, a~b if $a \leq b^2$ then

A. ~ is reflexive only

B. ~ is symmetric only

C. ~ is transitive only

D. ~ is an equivalent relation

Answer: D

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16. On Z, define a relation R as follows:

aRb if $5|(a-b)|$ Equivalent class [3] is equal to,

A. {.....,$-13,\ -8,\ -3, 0, 3, 8,$ .....}

B. {...,-7,-2,3,8,13,....}

C. {.....,-8,-2,3,7,11,.....}

D. {.....,-7,-2,3,7,12,.....}

Answer: B

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17. The function f satisfies the functional equation $3f(x)+2f\left(\frac{x+59}{x1}\right)=10x+30$ for all real $x\neq 1$. The value of $f(7)is$ 8 (b) 4 (c) -8 (d) 11

A. -4

B. 4

C. -2

D. 2

Answer: B

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18. Let $f: R \to R$ be defined by $f(x) = x^3 + x^2 + 5x + 2\sin x$, Then

A. f is one-to-one but not onto

B. f is onto but not one-to-one

C. f is both one-to-one and onto

D. f is neither one-to-one nor onto

Answer: C

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19. Let f be defined by:

$f(x) = \sqrt{x - \ln(1+x)}$. The domain of f is

A. $(-1, \infty)$

B. $[0, \infty)$

C. $[1, \infty)$

D. $(-\infty, \infty)$

Answer: A

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20. Let $f: R \to R$ be defined by

$f(x) = \dfrac{3x^2 + 3x - 4}{3 - 3x + 4x^2}$, then

A. f is one-to-one but not onto

B. f is onto but not one-to-one

C. f is both one-to-one and onto

D. f is neither one-to-one nor onto

Answer: D

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21. Let $f: R \to R$ be defined by

$f(x) = \dfrac{\left(x^6+1\right)x(x+1)+x^6+1}{x^2+x+1}$, Then f is

A. one-to-one but not onto

B. onto but not one-to-one

C. both one-to-one and onto

D. neither one-to-one nor onto

Answer: D

Watch Video Solution

22. On N, the set of natural numbers, a relation R is denned as follows:

$a, b \in N$, aRb if $a \mid b^2$ Then

A. R is reflexive only

B. R is symmetric and transitive only

C. R is reflexive and transitive only

D. R is an equivalence relation

Answer: A

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23. Let $A = \{a, a_2, \ldots\ldots a_n\}$ be a set containing a elements. The number of symmetric relations that can be denned on A is

A. $2^{n(n-1)/2}$

B. 2^n

C. $2^{n(n+1)/2}$

D. 2^{2n}

Answer: C

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24. Let C* = C - {0}, the set of non-zero complex number. Define a relation i? on C* as follows:

$z_1, z_2 \in C^{\cdot}$, $z_1 R z_2$ if $\frac{z_1 - z_2}{z_1 + z_2}$ is a real numbers then

A. R is reflexive and symmetric only

B. R is symmetric and transitive only

C. R is transitive only

D. R is an equivalence relation.

Answer: D

View Text Solution

25. On R, the set of real numbers define a relation ~ as follows:

$a, b \in R a \sim b$ if a-b=0 or irrational Then

A. R is reflexive, symmetric but not transitive

B. R is reflexive, transitive but not symmetri

C. R is anti-symmetric

D. R is an equivalence relation

Answer: A

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26. On Z, the set of integers define a relation R as follows:

$a, b \in Z, aRb$ if $3 \mid (2a + b)$ Then

A. R is reflexive, symmetric but not transitive

B. R is reflexive, transitive but not symmetric

C. R is anti-symmetric

D. R is an equivalence relation

Answer: D

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27. On R, the set of real numbers, define a relation R as follows:

xRy if $|x| \geq y$, Then

A. R is symmetric only

B. R is anti-symmetric

C. R is an equivalence relation

D. R is reflexive, but neither symmetric nor transitive

Answer: D

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28. Let $R = \{(x, y) \in N \times N : 3x + y = 91\}$, Then

A. R is an equivalence relation

B. R is only symmetric

C. R is only reflexive

D. R is not transitive

Answer: D

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29. Let D(R) denote the set of all differentiable functions defined on R. Define a relation ~ on D(R) as follows:

$f, g \in D(r)$, f~g if $f(x)g'(x) < 0 \forall x \in R$, Then

A. ~ is reflexive only

B. ~ is transitive but not symmetric

C. ~ is not transitive

D. None of the above

Answer: D

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30. Suppose [x] = greatest integer $\leq x$

Let $f(x) = \sin^{-1}\left[x^2 + \frac{1}{2}\right] - \cos^{-1}\left[x^2 - \frac{1}{2}\right]$, Then range of f is:

A. $\{0, \pi\}$

B. $\{-\pi, 0\}$

C. $\left\{-\frac{\pi}{2}, \frac{\pi}{2}\right\}$

D. $\left\{\frac{\pi}{2}, 0\right\}$

Answer: B

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Solved Examples Level 2 Single Correct Answer Type Questions

1. Let $A_n = \left[-\frac{1}{n}, \frac{1}{n}\right], n \in N,$ and $A = \bigcap_{n=1}^{\infty} A_n \Rightarrow a \not\in \bigcap_{n \neq 1}^{\infty} A_n = A$, and B={0}, then

A. A=B

B. $B \subseteq A, B \neq A$

C. $A \subseteq B, A \neq B$

D. none of these

Answer: A

View Text Solution

2. Suppose A, B and C are three sub-sets of a universal set U. If $(A \cup C) \cap (B \cup C') = \phi$, then

A. $A \cup B = C$

B. $A \cap B = \phi$

C. $A \cup B = U$

D. $A \cap B = C$

Answer: B

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3. Let C be a set containing (3n + 1) elements and A is a sub-set of C containing exactly an elements, then the number of ways of choosing sub-set BofC such that:

$A \subseteq B \subseteq C, B \neq A, B \neq C$, is

A. 2^{2n+1}

B. 2^{2n-1}

C. $2^{2n+1} - 2$

D. $2^{2n+1} - 2^2$

Answer: C

View Text Solution

4. Let X = {x : 1 le x le 50, x in N} A = {x: x is multiple of 2} B = {x: x is multiple of 7} Then find number of elements in the smallest subset of X which contain elements of both A and B

A. 27

B. 35

C. 29

D. 48

Answer: C

Watch Video Solution

5. If $g(x) = x^2 + x + x - 1$ and $g(f(x)) = 4x^2 - 10x + 5$ then find $f\left(\frac{5}{4}\right)$

A. $-\frac{3}{2}$

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. $\frac{3}{2}$

Answer: B

Watch Video Solution

6. Suppose a, b, c, d be four distinct real numbers. Let A = {a, b} and B = {c, d}. The number of elements in the smallest set X such that $A\Delta X = B$ and $B\Delta X = A$ is:

A. 16

B. 12

C. 8

D. 4

Answer: D

View Text Solution

7. Suppose $A_1, A_2, \ldots\ldots\ldots A_{45}$ are 45 sets each having 6 elements and $B_1, B_2, \ldots\ldots\ldots\ldots B_n$ are n sets each with 3 elements, let $\underset{i=1}{\overset{45}{\cup}} A_i = \underset{j=1}{\overset{n}{\cup}} B_j = S$ and each element of S belongs to exactly 10 of the $A_i's$ and exactly 9 of the $B_j s$. Then n is equal to

A. 27

B. 51

C. 81

D. 87

Answer: C

View Text Solution

8. Let A and B be two sets defined as follows:

$A = \left\{n \in N : 2^{2^n} + 1 \text{ ends in } 7\right\}$

$B = \{7n : n \in N\}$, then $A \cup B$ is equal to

A. B

B. $N - \{1\}$

C. N-B

D. none of these

Answer: B

View Text Solution

9. Let $f(x) = \sin(2x) + x - |x| \forall x \in R$ (where [x] = greatest integer ≤ 5). Then period of f is

A. π

B. $\pi + 1$

C. $2\pi - 1$

D. not defined

Answer: D

View Text Solution

10. Let $f(x) = 3x + 5 \forall x \in R, g^{-1}(x) = x^3 + 1 \forall x \in R,$ then $\left(f^{-1}.\, g\right)^{-1}(x)$ is equal to

A. $(3x + 5)^3$

B. $(3x + 5)^3 + 1$

C. $1 - (3x + 5)^3$

D. none of these

Answer: B

Watch Video Solution

11. Suppose f,g, $R \to R$. If g(x) defined by $g(x) = x^2 + x - 2$ and (g.f)(x) $= 4x^2 - 10x + 4$, then $f(x)$ may be given by

A. $f(x) = 2x + 3$

B. $f(x) = 3 - 2x$

C. $f(x) = 2x - 3$

D. $f(x) = 2 + 2x$

Answer: C

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12. The domain of the function $f(x) = \sqrt{\frac{4 - x^2}{[x] + 2}}$ where [x] denotes the greatest integer less than or equal to x,is

A. $(-\infty, -2) \cup (1, 2)$

B. $(-\infty, -2) \cup [-1, 2]$

C. $(-\infty, 2) \cup (1, 2]$

D. $(-\infty, -2) \cup [-1, 2)$

Answer: B

Watch Video Solution

13. The domain of $f(x) = \sqrt{\cos^{-1}\left(\frac{1-|x|}{3}\right)}$ is

A. $[-4, 0]$

B. $[0, 2/\sqrt{3}]$

C. $[-4, 4]$

D. $[-3, 3]$

Answer: C

Watch Video Solution

14. The domain of $f(x) = \frac{1}{\sqrt{x^{16} - x^{13} + x^4 - x + 1}}$, is

A. $(0, \infty)$

B. $(-1, \infty)$

C. $(-\infty, \infty)$

D. $(-\infty, 1]$

Answer: C

Watch Video Solution

15. The domain of

$f(x) = \sqrt{1-\sqrt{1-\sqrt{1-\sqrt{1-x^2}}}}$, is

A. $[-1, 0]$

B. $[0, 1]$

C. $(-1, 1)$

D. $[-1, 1]$

Answer: D

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16. The domain of $f(x) = \log_3 \log_4 \log_5(x)$ is

A. (0,5)

B. $(5, \infty)$

C. $(120, \infty)$

D. $(0, \infty)$

Answer: B

Watch Video Solution

17. If [x] denotes the greatest integer $\leq x$, then domain of

$f(x) = \dfrac{1}{\sqrt{[x]^2 - 7[x] + 12}}$ is

A. $(-\infty, 3) \cup [5, \infty)$

B. $(-\infty, 3] \cup (5, \infty)$

C. $R - \{3, 4\}$

D. $(-\infty, 3) \cup [4, \infty)$

Answer: A

Watch Video Solution

18. The domain of $f\left(x = \frac{1}{\sqrt{|\cos x| + \cos x}}\right.$ is $[-2n\pi, 2n\pi], n \in Z$ $2n\pi, 2n + 1\pi), n \in Z$ $\left.\frac{(4n+1)\pi}{2}, \frac{(4n+3)\pi}{2}\right), n \in Z$ $\left.\frac{(4n-1)\pi}{2}, \frac{(4n+1)\pi}{2}\right), n \in Z$

A. $\bigcup_{n=-\infty}^{\infty} ((2n-1)\pi, 2n\pi)$

B. $2n\pi, \overset{\infty}{\underset{n=-\infty}{(2n+1)\pi}}$

C. $\bigcup_{n=-\infty}^{\infty} \left(\left(2n - \frac{1}{2}\right)\pi, (2n+1)\frac{\pi}{2}\right)$

D. $n\pi, \overset{\infty}{\underset{n=-\infty}{(n+1)\pi}}$

Answer: C

Watch Video Solution

19. The value of $n \in N$ for which the function

$f(x) = \dfrac{\sin(nx)}{\sin\left(\frac{x}{n}\right)}$ has a period of 4π, is

A. 1

B. 2

C. 4

D. 8

Answer: B

Watch Video Solution

20. Let [x] = greatest integer $\leq x$ and $\{x\} = x - [x]$,

Let, $f_1(x) = \dfrac{2}{\pi}\left[\sin^{-1}(x) + \cos^{-1}(x)\right]$

$f_2(x) = \sin^2(\log_5 x) + \cos^2(\log_3 x)$

$f_3(x) = sgn(\{x\} + 1)$

and $f_4(x) = \sec^2[\{x\}] - \tan^2\{[x]\}$

$$sgn(x) = \begin{cases} -1 & \text{if } x < 0 \\ 0 & \text{if } x = 0 \\ 1 & \text{if } > 0 \end{cases}$$

Then which of the follwing is not true?

A. $f_1 = f_2$

B. $f_1 = f_3$

C. $f_1 = f_4$

D. $f_3 = f_4$

Answer: A

View Text Solution

21. Let A, B and C be three non-empty sets. Suppose $f: A \to B$ and $g: B \to C$. Then which of the following is not true?

A. if g o f is one-to-one, then/is one-to-one

B. if g of is onto, then g is onto

C. if g o f is one-to-one and onto, then/is one-to-one and onto

D. if f is one-to-one and g is one-to-one, then g . F is one-to-one

Answer: A

View Text Solution

22. Let $f: RofR$ be a function defined by

$f(x) = x^3 + px^2 + 7x + 4\cos x$ where $p \in R$. If f is invertible, p lies in

A. $(0, \infty)$

B. $[-3, 3]$

C. $(-\infty, 0)$

D. $[5, 11]$

Answer: B

View Text Solution

23. Let $A = [-1, 1]$. Define a relation R on A as follows:

$a, b \in A$, aRb if and only if $\sin^{-1}(a) + \cos^{-1}(b) = \pi/2$, Then

A. R is reflexive and symmetric only

B. R is symmetric and transitive only

C. R is transitive only

D. R is an equivalence relation

Answer: D

Watch Video Solution

24. Let A be a set containing n elements. If the number of reflexive relations that can be defined on A is 64, then n is equal to

A. 2

B. 3

C. 4

D. 6

Answer: B

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Solved Examples Numerical Answer Type Questions

1. Let A and B be two finite sets and let P(A) and P(B) respectively denote their power sets. If P(A) has 112 elements more than P(B), then the number of injective functions from A to B is .....

View Text Solution

2. Suppose $f: R - \{5/3\} \to R - \{5/3\}$ is given by $f(x) = \frac{5x + a}{3x - 5}$. If $(fof)(x) = x \, \forall x \in R - (5/3)$ then $-3a$ can be equal to .....

View Text Solution

3. Suppose $f:[1,\infty) \to [1,\infty)$ is defined by $f(x) = \frac{1}{2}\left(1+\sqrt{1+4\log_2 x}\right)$, then $f^{-1}(3)$ = ...

Watch Video Solution

4. Let $f: R - \{0\} \to R$ be defined by $f(x) = x + \frac{1}{x}$, then $7 + f((x))^4 - f\left(x^4\right) - 4(f(x))^2$ is equal to.....

Watch Video Solution

5. If A = {a, b, c, d}, then the number of functions on the set A which are not one-one, is_

Watch Video Solution

6. Suppose A and B are two sets such that A contains 5 elements and $B - A = \phi$. The maximum possible number of non-empty proper subsets of B is .....

View Text Solution

7. Suppose P{S) denote the power set of the set S. Let A = {1}. If the number of elements in the P(P(P(P(A)))) is 4n then n =__

Watch Video Solution

8. Let $g(x) = x^2 + x - 1 \forall x \in R$ and $(gof)(x) = 4x^2 + 10x + 5 \forall x \in R$, then $f(7/2)$ = ...

Watch Video Solution

9. Let $X = \{n \in N : 1 \leq n \leq 50\}$. If $A = \{n \in X : \text{ n is a multiple of } 2 \ \}$ and $B = \{n \in X : \text{ n is a multiple of } 7\}$, then the number of elements in the largest subset of X containing neither an element of A nor an element of B is_____

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10. Let S be the set of all real roots of the equation, $3^x(3^x-1)+2=|3^x-1|+|3^x-2|$

Watch Video Solution

11. Let $W=N\cup\{0\}$. Suppose $f:W\to W$ is a function such that $f(0)=0, f(1)=1, f(2)=2$ and $f(x)=f(x-2)+f(x-3)$ for x=3,4,..... Then $f(9)$ =.....

Watch Video Solution

12. Let S = {1, 2, 3, 4, 5}. The number of ordered pairs of subsets (A, B) of S such that $A\cap B=\{3\}$ and $A\cup B=S$ is.....

View Text Solution

13. The number of equivalence relations that can be defined on set {a, b, c}, is

A. 5

B. 6

C. 12

D. 16

Answer: a

Watch Video Solution

14. Let A = {a, b, c, d}. The number of invertible functions $f: A \to A$ satisfying the following conditions:

$f(d) = d$, $f(a) \neq a$, $f(b) \neq b$ is.....

View Text Solution

15. Define $f: R \to R$ by

$f(x) = \dfrac{\sin^2 x + \cos^4 x}{\cos^2 x + \sin^4 x}$, then the range of f consists of exactly ..... Element(s).

Watch Video Solution

16. For $x \in R - \left\{ -\dfrac{1}{n}, n \in N \right\}$, define

$f(x) = \lim_{n \to \infty} \left(\dfrac{x}{x+1} + \dfrac{x}{(x+1)(2x+1)} + \dfrac{x}{(2x+1)(3x+1)} \right)$ + ...

+ upto n terms

then range of f contains exactly..... Element(s).

Watch Video Solution

17. If $f(x) = \dfrac{a^x + a^{-x}}{2}$ and $f(x+y) + f(x-y) = kf(x)f(y)$ then $k =$

Watch Video Solution

18. Let f,g : $R \to R$ be defined by $f(x) = (x-2)|x-2| \forall x \in R$

$g(x) = \sqrt{(x-2)^2} \forall x \in R$

$S = \{x : x \in R \text{ and } f(x) = g(x)\}$, number of elements in S is.....

Watch Video Solution

19. Define $f : R \to R$ by

$f(x) = 4\cos^4\left(\frac{x-\pi}{4\pi^2}\right) - 2\cos\left(\frac{x-\pi}{2\pi^2}\right) \forall x \in R$ If the period of f is $k\pi^3$, then k = ...

Watch Video Solution

20. Let $f(x) = \frac{1}{x}, g(x) = \frac{1}{9x^2-1}$ and $h(x) = \frac{11x}{x+3}$ be three functions.

Let $F(x) = (h.\, g.\, f)(x)$

Suppose domain of F is $R - \{x_1, x_2, \ldots\ldots, x_n\}$, where x_1, x_2,.....x_n are n distinct real numbers. Then n =.....

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Exercise Concept Based Single Correct Answer Type Questions

1. If U is the universal set and $A \subseteq B \subseteq U$ then which of the following is true?

A. $U - B = U - A$

B. $U - A \subseteq U - B$

C. $U - B \subseteq U - A$

D. $U - A \subseteq (U - A) \cap (U - B)$

Answer: C

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2. Suppose U is Ihe universal set and A, $B \subseteq U$, then $(A \cap (U - B)) \cap B$ is equal to

A. $A \cup B$

B. $A \cap B$ is singleton

C. A

D. B

Answer: A

View Text Solution

3. Suppose A, B and C are three sets. Consider the following:

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

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

Which of the above is true?

A. (i)only

B. (ii)only

C. Both (i) and (ii)

D. Neither of (i) and (ii)

Answer: C

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4. Let U be the universal set B, C are sub-sets of U. If A = $B \cup C$, then U -(U - ((U-A')))) is equal to

A. $B \cup C$

B. $B \cap C$

C. $B' \cap C'$

D. $B' \cup C'$

Answer: C

Watch Video Solution

5. Let $A = \{x \in R : |x+1| = |x| + 1\}$ and $B = \{x \in R : |x-1| = |x| - 1\}$, Then

A. A = B

B. $B \subseteq A$

C. $A \subseteq B$

D. $A \cup B = R$

Answer: B

Watch Video Solution

6. Let $A = \{x; x \in N,\ x$ is a multiple of 3$\}$ and $B = \{x : x \in N\ and\ x$ is a multiple of 5$\}$. Write $A \cap B$.

A. A

B. B

C. C

D. $A \cap B$

Answer: C

Watch Video Solution

7. Let $S = \{(x, y) \in N \times N, x^2 - y^2 = 10, 21, 954\}$, then

A. $S = \phi$

B. S contains exactly one element

C. S is finite and contains at least two elements

D. S is an infinite set

Answer: A

View Text Solution

8. Let S = $\{a_1, a_2, \ldots\ldots a_n\}$ where a_1, a_2....., a_n are nonzero real numbers. If the number of ordered pairs (a_i, a_j), with i < j such that $a_i a_j > 0$ is 99 and the number of ordered pairs (a_i, a_j) with $i < j$ such that $a_i a_j < 0$ is 91, then n is equal to

A. 11

B. 13

C. 20

D. 18

Answer: C

View Text Solution

9. Let P{X) denote the power set of X and A = {1,2}, then P(P(A)) contains m elements where m is equal to

A. 4

B. 8

C. 16

D. 32

Answer: C

Watch Video Solution

10. Let $A = \{64n, n \in N\}$

and $B = \left\{3^{2n+2} - 8^n - 9, n \in N\right\}$ then

A. $A \subseteq B, A \neq B$

B. $B \subseteq A, B \neq A$

C. A = B

D. $A \cap B = \phi$

Answer: B

Watch Video Solution

11. If $B \cap C \subseteq A$, then $(B - A) \cap (C - A)$ is equal to

A. $B \cap C$

B. $B \cup C$

C. ϕ

D. A'

Answer: C

Watch Video Solution

12. If n(U) = 25, n(A) = 12, n(B)=11, $n(A \cap B) = 4$, where U is the universal set, A and B are sub-sets of U, then $n((A \cup B)')$ is equal to

A. 3

B. 8

C. 9

D. 12

Answer: B

View Text Solution

13. In a class of 80 students who have appeared in a test in Mathematics and a test in Physics, 55 students have passed in Mathematics and 57 students have passed in Physics, then the number of students who have passed in Physics only is

A. 52

B. 32

C. 38

D. 65

Answer: B

View Text Solution

14. In a city 20 per cent of the population travels by car, 40 per cent travels by bus and 8 per cent travels by both car and bus. Then percentage of persons travelling by car or bus is

A. 52

B. 60

C. 80

D. 70

Answer: A

View Text Solution

15. Out of 800 boys in a school, 242 played cricket, 250 played hockey and 340 played basketball. Of the total, 64 played both basketball and hockey, 80 played cricket and basketball and 40 played cricket and hockey, 34 played all the three games. The number of boys who did not play any game is

A. 118

B. 216

C. 240

D. 160

Answer: A

View Text Solution

16. If S is a relation on a set A, then

A. A= S

B. $S = A \times A$

C. $S \subseteq A \times A$

D. $A \subseteq S \times S$

Answer: C

Watch Video Solution

17. Let S = Set of all children. Define R on S as follows: $a, b \in S, aRb$ if a and b have the same mother. Then

A. R is reflexive and symmetric only

B. R is reflexive and transitive only

C. R is symmetric and transitive only

D. R is an equivalence relation

Answer: D

Watch Video Solution

18. Let S = Set of all women in the world. Define R as follows: $a, b \in S$, aRb if a and b have at least one of the two parents in common, Then

A. R is reflexive and symmetric only

B. R is reflexive and transitive only

C. R is symmetric and transitive only

D. R is an equivalence relation

Answer: A

View Text Solution

19. Let S = Set of all women in the world. Define R as follows:

$a, b \in S$, aRb if a is mother of b. Then R is

A. reflexive

B. symmetric

C. not a relation

D. none of these

Answer: D

Watch Video Solution

20. Let $A = \{a, b, c\}, B = \{5, 7\}$, and set C be a set containing n elements such that $B \cap C = \phi$. If $A \times (B \cup C)$ has 33 elements, then n

is equal to

A. 7

B. 8

C. 9

D. 11

Answer: C

Watch Video Solution

21. On Z, a relation R is defined as follows:

$a, b \in Z, aRb$ if 7|(a-b), then which of the following is not true?

A. R is reflexive

B. R is symmetric

C. R is transitive

D. R is anti-symmetric

Answer: D

View Text Solution

22. On Z, a relation R is defined as follows: $a, b \in Z, aRb$ if a divides b, Then

A. R is reflexive and transitive only

B. R.is transitive only

C. R is symmetric and transitive

D. R is an equivalence relation

Answer: B

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23. On Z, a relation R is defined as follows: $a, b \in Z, aRb$ if 7 divides a -b

The equivalence class containing -17 is

A. {...,-17,-10,-3,4,11,...}

B. {...,-17,-9,-2,3, 10, ...}

C. {...,-17,-13,-10,7,13,...}

D. none of these

Answer: A

View Text Solution

24. Let A, B and C be three sets, then which of the following is true?

A. $A \times (B - C) = (A - B) \times (A - C)$

B. $A \times (B - C) = A \times B - A \times C$

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

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

Answer: B

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25. Let A = $\{x \in N : x$ is a multiple of 3 and $x \leq 100\}$

B =$\{x \in N : x$ is a multiple of 5 and $x \leq 100\}$, The number of elements of

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

A. 6

B. 18

C. 36

D. 72

Answer: C

View Text Solution

26. Let ~ be a relation defined on $N \times N$ as follows:

(a,b),(c,d) $\in N \times N$, (a, b)~(c, d) if ad = bc, then

A. ~ is reflexive and symmetric only

B. ~ is anti-symmetric

C. ~ is transitive only

D. ~ is an equivalence relation

Answer: D

Watch Video Solution

27. Let A = {a, b, c} andR = {(a, b), (b, c)}. The minimum number of ordered pairs that must be added to R to make it an equivalence relation is

A. 5

B. 6

C. 7

D. 8

Answer: C

Watch Video Solution

28. Suppose A and B have exactly n elements in common, then the number of elements lying in (A x B) n (B x A), is

A. n

B. 2n

C. n^2

D. 0

Answer: C

View Text Solution

29. On Z, define R as follows:

$a, b \in Z, aRb$ if $7 \mid \left(a^2 - b^2\right)$, then R is

A. reflexive and transitive only

B. reflexive and symmetric only

C. symmetric and transitive only

D. an equivalence relation

Answer: D

View Text Solution

30. Suppose R is a reflexive and transitive relation on a set A and let $S = R \cap R^{-1}$. Which of the following is not true?

A. S is reflexive and transitive

B. S is anti-symmetric and symmetric

C. S is symmetric and reflexive

D. S is an equivalence relation

Answer: D

View Text Solution

31. Let R_1 and R_2 be equivalence relations on a set A, then $R_1 \cup R_2$ may or may not be

A. S is reflexive but not symmetric

B. S is reflexive and symmetric but not transitive

C. S is an equivalence relation

D. S may not be transitive

Answer: B

Watch Video Solution

32. On Z, define R as follows:

$a, b \in Z, aRb$ if $3 \mid \left(a^2 - b^2\right)$, then R is an equivalence relation on Z. Equivalence class containing 1, that is, [1] is given by

A. {...,-3,0,3,6,...]

B. {...,-3,-1,1,3,...]

C. {...,-4,-2,1,2,4,5,7,8,...}

D. {...,-4,-2,-1, 1,2,4,5,7,8, ...}

Answer: D

View Text Solution

33. Let $f(x) = \sin(\pi[x]) + \sin\left(\left[\pi^2\right]x\right) + \cos\left(\left[-\pi^2\right]\frac{x}{3}\right) \forall x \in R$, then $f(\pi/4)$ is equal to

A. $1/\sqrt{2}$

B. $-1/\sqrt{2}$

C. $\sqrt{2}$

D. $-\sqrt{2}$

Answer: A

Watch Video Solution

34. The domain of $f(x) = \log|\log x| is \quad (0, \infty)$ (b) $(1, \infty)$ (c) $(0, 1) \cup (1, \infty)$ (d) $(-\infty, 1)$

A. $(1, \infty)$

B. (0,1)

C. $(0, \infty)$

D. $(0, 1) \cup (1, \infty)$

Answer: D

Watch Video Solution

35. Let /be a function such that

$3f(x) + 22f\left(\frac{1}{x}\right) = 7x, \forall x \neq 0$, then for each $x \neq 0$, $f(x)$ is equal to

A. $\frac{7}{5}\left(3x - \frac{2}{x}\right)$

B. $\frac{7}{5}\left(2x + \frac{3}{x}\right)$

C. $\frac{1}{5}\left(2x + \frac{3}{x}\right)$

D. $\frac{2}{5}\left(3x - \frac{1}{x}\right)$

Answer: A

Watch Video Solution

36. Let $f: R \to R$ be defined by

$f(x) = \frac{5^{2x}}{5^{2x} + 5}$, then $f(x) + f(1 - x)$ is equal to

A. 1

B. 5

C. 25

D. $\sqrt{5}$

Answer: A

Watch Video Solution

37. Let $g(x) = 1 + x - [x]$ and $f(x) = \begin{cases} -1, & x < 0 \\ 0, & x = 0 \\ 1, & x > 0 \end{cases}$, then for all x, $f[g(x)]$ is equal to

A. 1

B. x

C. $x + 1$

D. $1 - x$

Answer: A

Watch Video Solution

38. If $f(x) = 27x^3 - \frac{1}{x^3}$ and α, β are roots of $3x - \frac{1}{x} = 2$ then

A. $f(\alpha) = f(\beta)$

B. $f(\alpha) + f(\beta) = 150$

C. $f(\alpha) - f(\beta) = 3$

D. $f(\alpha) + f(\beta) = 125$

Answer: A

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39. Let $f(x) = \ln(x-1)(x-3)$ and $g(x) = \ln(x-1) + \ln(x-3)$ then,

A. $f(x) = g(x)\,\forall x$

B. $f(x) = g(x)\,\forall x \in (3, \infty)$

C. $f(x) = g(x),\ \forall x \in (-\infty, 1) \cup (3, \infty)$

D. $f(x) = g(x)\,\forall x \in R - (1, 3)$

Answer: B

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40. Let $f(x) = \cos(x) + \cos\left(\sqrt{3}x\right) \forall x \in R$. The number of values of x for which f(x) is maximum is

A. 1

B. 2

C. 5

D. infinite

Answer: A

Watch Video Solution

41. The domain of $f(x) = \sqrt{\frac{2 - |x|}{3 - |x|}}$ is

A. $(-\infty, -3) \cup)3, \infty)$

B. $[-2, 3)$

C. $(-\infty, -3) \cup (3, \infty) \cup [-2, 2]$

D. $(-\infty, \infty) - \{-3, 3\}$

Answer: C

Watch Video Solution

42. The range of $f(x) = \sqrt{3x^2 - 10x + 12}$ is

A. $\left[\sqrt{\frac{11}{3}}, \infty\right)$

B. $\left[-\frac{\sqrt{11}}{3}, \infty\right)$

C. $[\sqrt{3}, \infty)$

D. $(-\sqrt{3}, \infty)$

Answer: A

Watch Video Solution

43. The domain of $f(x) = \cos^{-1}\left\{\log_2\left(\frac{1}{2}x^2\right)\right\}$ is

A. $(2, \infty)$

B. $[-2, -1] \cup [1, 2]$

C. $[-2, 2]$

D. $(-\infty, -2) \cup (2, \infty)$

Answer: B

View Text Solution

44. Suppose $f: R \to R$ be defined by

$f(x) = \begin{cases} x & \text{if } x \in Q \\ 1 - x & \text{if } x \in R - Q \end{cases}$, Then for each $x \in Rf(x)$ is equal to

A. $1 - x$

B. x

C. $x - 1$

D. $-x$

Answer: B

View Text Solution

45. Let $f:[4,\infty) \to [1,\infty)$ be defined by

$f(x) = 11^{x(4-x)}\ \forall x \geq 4$

Then $f^{-1}(x)$ is given by

A. $2 - \sqrt{4 + 1\log_{11}(x)|}\ \forall x \geq 1$

B. $2 + \sqrt{4 + \log_{11}(x)}\ \forall x \geq 1$

C. $2 + \sqrt{4 - \log_{11}(x)}\ \forall x \geq 1$

D. $\sqrt{4 + \log_{11}(x) - 2}\ \forall x \geq 1$

Answer: B

Watch Video Solution

Exercise Level 1 Single Correct Answer Type Questions

1. Suppose A, B and C are three sets such that $A\Delta B = \phi$, then $A\Delta(B\Delta C)$ is equal to

A. ϕ

B. C

C. A

D. B

Answer: B

View Text Solution

2. Let A, B and C be three sub-sets of a universal set U, If $A' \cap C = B' \cap C$ and $A \cap C' = B \cap C'$, then

A. $A \cap B = \phi$

B. A= B

C. $A \cup B = U$

D. $A \cup B \subseteq C'$

Answer: B

Watch Video Solution

3. Let $A_n = \left\{ x \in C : |z|^2 \leq \frac{1}{n} \right\}$ for each $n \in N$. Then $\bigcap_{n=1}^{\infty} A_n$ is

A. a singleton set

B. not a finite set

C. an empty set

D. a finite set with more than one element

Answer: A

View Text Solution

4. Let A,B and C be three sets such that $P(A) \cap P(B) = P(C)$, then

A. $A \cap B \subseteq C, A \cap B \neq C$

B. $C \subseteq A \cap B, A \cap B \neq C$

C. $A \cap B = C$

D. $A \cap B \cap C = \phi$

Answer: C

View Text Solution

5. Let A, B and C be three sets such that $P(A) \cup P(B) = P(C)$, then

A. $A \cap B = C$

B. $A \cup B = C$

C. $A \cup B \subseteq C$

D. $C \subseteq A \cap B$

Answer: C

View Text Solution

6. A class has 172 students. The following data shows the number of students opting one or more subjects: Mathematics 125, Physics 95, Chemistry 65 Mathematics and Physics 55

Mathematics and Chemistry 53

Physics and Chemistry 48 Mathematics, Physics and Chemistry 43

The number of students who opted only Physics is

A. 35

B. 45

C. 29

D. 37

Answer: A

Watch Video Solution

7. In a class of 75 students, the number of students studying different Subjects are 43 in Mathematics 44 in Physics, 39 in Chemistry, 32 in Mathematics and Physics, 29 in Mathematics and Chemistry 27 in Physics and Chemistry and 24 in all three subjects. The number of students who have taken exactly one subject is

A. 26

B. 29

C. 27

D. 22

Answer: D

Watch Video Solution

8. Let $A = \{(x, y) \in R \times R : y = 5^x + 3^x\}$

$B = \{(x, y) \in R \times R : y = 4^x\}$, Then

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at leas two points but is finite

D. $A \cap B$ is an infinite set

Answer: B

Watch Video Solution

9. $If A = \{x, y) : x^2 + y^2 = 25\}$ and

$B = \{(x, y) : x^2 + 9y^2 = 144\}$, then $A \cap B$ contains

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at least two points but is finite

D. $A \cap B$ is an infinite set

Answer: C

Watch Video Solution

10. Let $A = \{z : z \in C, iz^3 + z^2 - z + i = 0\}$ and $B = \{z : z \in C, |z| = 1\}$, Then

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at least two points but is finite

D. $A \cap B$ is an infinite set

Answer: C

Watch Video Solution

11. Let A and B be two finite sets such that $A \cap B$ is a singleton. If n(A) = 6, n(B) = 4, then number of subsets of $A \Delta B$ is

A. 256

B. 128

C. 512

D. 64

Answer: A

Watch Video Solution

12. A set contains 2n+1 elements. The number of subsets of this set containing more than n elements :

A. 2^{2n}

B. $2^{2n} - 1$

C. $2^{n+1} - 1$

D. 2^{n+1}

Answer: C

Watch Video Solution

13. 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

A. 2^{18}

B. 2^{10}

C. 2^{15}

D. 2^{12}

Answer: C

Watch Video Solution

14. Let N denotes the set of all natural numbers. Define two binary relations on N as:

$R_1 = \{(x, y) \in N \times N : 2x + y = 10\}$

$R_2 = \{(x, y) \in N \times N : x + 2y = 10\}$, Then

A. range of R_1 is {2,4,8}

B. range of R_2 is {1,2,3,4}

C. both R_1 and R_2 are symmetric relations

D. both R_1 and R_2 are transitive relations

Answer: B

Watch Video Solution

15. Consider the following two binary relations on the set

$A = \{a, b, c\}, R_1 = \{(c, a), (b, b), (a, c), (c, c), (b, c), (a, a)\}$

$R_2 = \{(a, a), (a, b), (c, c), (b, a), (b, b), (a, c)\}$, Then:

A. R_2 is symmetric but it is not transitive

B. both R_1 , and R_2 are not symmetric

C. both R_1 and R_2 are transitive

D. R_1 is not symmetric but it is transitive

Answer: A

Watch Video Solution

16. On C, the set of complex number, define a relation R as follows:

$R = \{(z_1, z_2) : z_1, z_2 \in C, |z_1 + z_2| = |z_1| + |z_2|\}$

A. R is antisymmetric

B. R is reflexive, symmetric but not transitive

C. R is an equivalence relation

D. R is a partial order

Answer: B

View Text Solution

17. Let $M = \left\{ \begin{pmatrix} a & b \\ -b & a \end{pmatrix} : a, b \in R \text{ and } a^2 + b^2 \neq 0 \right\}$

Define a relation ~ on M as follows:

$A, B \in M$, $A \sim B$ if $ABA^{-1} = B$

A. R is an equivalence relation.

B. $R = M \times M$

C. R is a partial order

D. none of these

Answer: A

View Text Solution

18. Let A and B be two sets such that A - B = B-A, then

A. $A \Delta \phi = \phi$

B. $A \cap B = \phi$

C. $A \cup B = A \Delta B$

D. $A \cup B = A \cap B$

Answer: D

Watch Video Solution

19. Let A and B be two sets defined as follows:

$A = \{(x, y) \in R \times R : y = \sin x\}$

$B = \{(x, x) : x \in R\}$

A. $A \cap B = \{(0, 0)\}$

B. $A \cap B = B$

C. $A \cap B = \phi$

D. $A \Delta B = A \cup B$

Answer: A

Watch Video Solution

20. Suppose $A_1, A_2, \ldots\ldots\ldots A_{45}$ sets such that each A_i has 6 elements and $B_1, B_2, \ldots\ldots\ldots B_n$ are n sets each with 3 elements. Let $\bigcap_{i=1}^{45} A_i = \bigcap_{j=1}^{n} B_j = 5$ and each element of S belongs to exactly 10 of the A_i's and exactly 9 of the B_j's. Then n is equal to

A. 27

B. 51

C. 81

D. 87

Answer: C

View Text Solution

21. Consider the function $f(x) = \dfrac{x-1}{x+1}$

What $\dfrac{f(x)+1}{f(x)-1}$ equal to ?

A. x

B. $-x$

C. 0

D. 1

Answer: C

Watch Video Solution

22. If $f(x) = \frac{x+1}{x-1}$ then the value of $f(f(f(x)))$ is :

A. $-x$

B. x

C. 0

D. $x+1$

Answer: B

Watch Video Solution

23. Let $f(x) = \frac{x^2}{(1+x^2)}$ .Then range (f) =?

A. $[0, \infty)$

B. $(0, 1]$

C. $[0, 1)$

D. $[0, 1]$

Answer: C

Watch Video Solution

24. Let $f, g: R \to R$ by

$f(x) = x|x| - 1 \forall x \in R$ and $g(x) = \begin{cases} \frac{3}{2}x & \text{if } x > 0 \\ 2x & \text{if } x \leq 0 \end{cases}$. The number of subsets of S is

A. 2

B. 4

C. 16

D. infinite

Answer: B

View Text Solution

25. Let A = [-1, 1]. Which of the following functions on A is not a bijection?

A. $f(x) = x[x]$

B. $f(x) = x^3$

C. $f(x) = \sin\left(\frac{\pi}{2}x\right)$

D. $f(x) = \cos\left(\frac{\pi}{2}.\, x\right)$

Answer: D

Watch Video Solution

26. Let $f: R - \{0\} \to R$ be defined by $f(x) = x + \frac{1}{x}$, then range of $g(x) = (f(x))^4 - f(x^4) - 4(f(x))^2$, is

A. $R - (2)$

B. $\{2\}$

C. $\{-2\}$

D. $R - \{2\}$

Answer: C

Watch Video Solution

27. Let A, B and C be three non-empty sets. Suppose $f: A \to B$ and $g: B \to C$ are two functions such that $gof: A \to C$ is one-to-one, then

A. f and g are both one-to-one

B. f is one-to-one g may not be one-to-one

C. f may not be one-to-one but g is one-to-one

D. both f and g need not be one-to-one

Answer: B

View Text Solution

28. Suppose: $f: R \to S$ is defined by $f(x) = \frac{1}{x^2 + 2x + 2} \forall x \in R$, If f is a surjective function, then S is given by

A. $[1, \infty)$

B. $(1, \infty)$

C. $[0, 1]$

D. $(0, 1]$

Answer: D

Watch Video Solution

29. If $f: R \to R$ is defined by $f(x) = [2x] - 2[x]$ for $x \in R$, where [x] is the greatest integer not exceeding x, then the range of f is

A. Z

B. N

C. $\{0, 1\}$

D. $\{-1, 0, 1\}$

Answer: C

Watch Video Solution

30. Domain of

$$f(x) = \sqrt{2x-1} + \sqrt{13}\cos^{-1}\left(\frac{2x-1}{2}\right)$$ is

A. $\left[\frac{1}{2}, \frac{3}{2}\right]$

B. $\left\{\frac{1}{2}\right\}$

C. $\left[\frac{1}{2}, 1\right]$

D. $\left[\frac{1}{2}, \frac{\sqrt{3}}{2}\right]$

Answer: A

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Exercise Level 2 Single Correct Answer Type Questions

1. Let $f_1(x) = \frac{x}{x+1} \forall x \in R^+$, se of positive real numbers, For $k \geq 2$, define

$f_k(x) = f_{k-1}(f_1(x)) \forall x \in R^+$

Then $f_{2020}\left(\frac{1}{2020}\right)$ is equal to

A. $\frac{1}{4040}$

B. $\frac{1}{2020}$

C. $\frac{1}{4041}$

D. $\frac{1}{2021}$

Answer: A

Watch Video Solution

2. Let $f: N \to N$ be defined by

$f(x) = x - (1)^x \, \forall x \in N$, Then f is

A. one-to-one but not onto

B. one-to-one and onto

C. onto but not one-to-one

D. neither onto nor one-to-one

Answer: B

Watch Video Solution

3. Let $f: [0, \infty) \to [0, \infty)$ and $g: [0, \infty) \to [0, \infty)$ be two functions such that f is non-increasing and g is non-decreasing. Let

$h(x) = g(f(x)) \forall x \in [0, \infty)$. If $h(0) = 0$, then h(2020) is equal to

A. 0

B. 1

C. 1010

D. 2020

Answer: A

Watch Video Solution

4. The domain of $f(x) = \sqrt{\frac{\pi}{2} - \frac{\sin^{-1}(x + |x|)}{3}}$ is

A. $\left[0, \frac{2}{3}\right]$

B. $[0, 1]$

C. $\left[0, \frac{3}{2}\right]$

D. $\left(-\infty, \frac{3}{2}\right]$

Answer: D

Watch Video Solution

5. The domain of $f(x) = \tan^{-1}\left(\frac{1}{\sqrt{x^{12} - x^9 + x^6 - x^3 + 1}}\right)$ is

A. R

B. $(-\infty, 0)$

C. $[0, \infty)$

D. $R - [-1, 1]$

Answer: A

View Text Solution

6. Let $f: R \to R$ be defined by

$f(x) = 5^{-|x|} - 5^x + sgn\left(e^{-x}\right) + 4$ where sgn (x) denotes the signum function of x. Then

A. f is one-to-one but not onto

B. f is one-to-one and onto

C. f is not onto but one-to-one

D. f is neither one-to-one nor onto

Answer: D

Watch Video Solution

7. Suppose p,q $\in R$, and Let $f(x) = x^2 + px + q \forall x \in R$

If $f(5+x) = f(5-x) \forall x \in R$, then

A. $f(3) < f(4) < f(5)$

B. $f(5) < f(3) < f(4)$

C. $f(4) < f(3) < f(5)$

D. $f(5) < f(4) < f(3)$

Answer: D

View Text Solution

8. Let sgn (x) denote the signum function of x. Let $A = \left\{x \mid x \neq \frac{1}{2}n\pi, n \in Z\right\}$ Define $f: A \to R$ by $f(x) = sgn(\cos x) + sgn(\sin x) + sgn(\tan x) + sgn(\cot x)$ Then range of f is

A. {-2,0,4}

B. {0,4}

C. {-4,-2,0,4}

D. {-2,4}

Answer: A

Watch Video Solution

9. Let S = {1, 2, 3, 4}. The number of functions $f: S \to S$ which satisfy the condition $f(f(x)) = x \forall x \in S$, is

A. 9

B. 10

C. 11

D. 12

Answer: B

View Text Solution

10. Let $a \in R$ suppose f is defined by $f(x) = \frac{x-1}{a+1-x^2}$ If range of f does not contain the interval $\left[-1.\ -\frac{1}{3}\right]$ then a lies in

A. $(-1, \infty)$

B. $(0, \infty)$

C. $\left(-\infty, -\frac{1}{4}\right)$

D. $(-\infty, -1)$

Answer: C

Watch Video Solution

11. Let $f: R \to (1, \infty)$ be defined by

$f(x) = \log_5\left(\sqrt{3x^2 - 4x + a + 5}\right)$. If f is surjective, then

A. $a = \frac{4}{3}$

B. $a < \frac{1}{3}$

C. $a > \frac{4}{3}$

D. $a = \frac{1}{3}$

Answer: A

View Text Solution

12. Suppose $a \in R$. Define f and g as follows:

$f(x) = \left(a^2 - 4a + 3\right)x^2 + \left(a^2 - 1\right)a \, \forall x \in R$ and

$g(x) = \left(a^2 - 5a + 6\right)x^3 + \left(a^2 - 3a + 2\right)x + \left(a^3 - 1\right) \forall x \in R$

The number of values of a for which $f(x) = g(x) \, \forall x \in R$

A. 0

B. 1

C. 2

D. infinite

Answer: B

Watch Video Solution

13. Let $f(x) = |x - 2| \, \forall x \in R$ and $g(x) = f(f(f(x)))$, then the number of solutions of $g(x) = \frac{3}{2}$ is

A. 4

B. 6

C. 8

D. 10

Answer: B

View Text Solution

14. Let f be a one-one function with domain $\{x, y, z\}$ and range $\{1, 2, 3\}$. It is given that exactly one of the following statements is true and the remaining two are false $f(X) = 1$, $f(y) \neq 1 f(z) \neq 2$ determine $f^{-1}(1)$

A. {y}

B. {x}

C. {z}

D. {x,y}

Answer: A

Watch Video Solution

15. Let $f(x) = (x+2)^2 - 4, x \geq 2$. Let $S = \{x : f(x) = f^{-1}(x)\}$, Then S is equals to

A. {0}

B. {0,4}

C. $\left\{0, 2, \frac{1}{2}(\sqrt{5}-1)\right\}$

D. $\left\{0, 4, \frac{1}{2}(\sqrt{5}-1), \frac{1}{2}(\sqrt{5}+1)\right)$

Answer: A

Watch Video Solution

16. Let $= [1, \in ftY)$. Define $f: S \to S$ by $f(x) = 5^{x(x+1)}$

Then $f^{-1}(x)$ is equal to

A. $\left(\frac{1}{5}\right)^{x(x-1)}$

B. $\frac{1}{2}\left[1 + \sqrt{\log_5(x)}\right]$

C. $\frac{1}{2}\left[1 + \sqrt{1 + 4\log_5(x)}\right]$

D. $\left(\frac{1}{5}\right)^{x(1-x)}$

Answer: C

View Text Solution

17. Suppose $a > 0$ and $n \in N$ is odd.

Let $f: R \to R$ be defined by $f(x) = (a - x^n)^{1/n}$, then $f(f(x))$ is equal to:

A. nx

B. $\frac{1}{n}x$

C. x

D. $|x|$

Answer: C

Watch Video Solution

18. Let $f: R \to R$ be defined by

$f(x) = |2 - x| - |x + 1|$

The number of integral values of a for which $f(x) = a$ has exactly one solution is:

A. 3

B. 5

C. 6

D. 8

Answer: B

Watch Video Solution

19. Let S= [a,b] where $a < b$. Suppose $f: S \to [2, 28]$ defined by $f(x) = 5\sin x + 12\cos x + 15$. If f is one-to-one and onto, then the least value of b-a is

A. $\frac{\pi}{2}$

B. π

C. $\frac{3}{2}\pi$

D. 2π

Answer: B

Watch Video Solution

20. Let $A = \{(x, y) \in R \times R : y = 5^x + 12^x\}$

$B = \{(x, y) \in R \times R, y = 13^x\}$

Then

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at least two points but is finite

D. $A \cap B$ is an infinite set

Answer: A

Watch Video Solution

21. Let $A = \{(x, y) : x^2 + y^2 = 36\}$ and $B = \{(x, y) : x^2 + 9y^2 = 100\}$,

Then

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at least two points but is finite

D. $A \cap B$ is an infinite set

Answer: C

View Text Solution

22. Let $A = \{z : z \in C, |z - i| = |z + 1|\}$ and $B = \{z : z \in C, |z| = 1\}$,

Then

A. $A \cap B$ is a singleton

B. $A \cap B = \phi$

C. $A \cap B$ consists of at least two points but is finite

D. $A \cap B$ is an infinite set

Answer: C

View Text Solution

23. Let A = {a,b,c,d} and R = {(a,b),(a,c),(a,d), (b,c), (b,d), (c,d)} then R =R is equal to

A. {(a,b),(a,c),(b,d),(c,d)}

B. {(a,c),(a,d),(b,d)}

C. {(a, c), (a, d), (b, c)}

D. {(a, b), {a, c), (c, d), (b, d)}

Answer: B

View Text Solution

24. Let A = {a,b,c} and $R_1 = \{(a, a), (c, b), (b, c)\}$

$R_2 = \{(b, b), (c, c)\}$

Which of the following is true?

A. R_1 and R_2 are both transitive

B. R_1 and R_2 are both symmetric

C. R_1 and R_2 are both reflexive

D. R_2 is an equivalence relation but R_1 is not

Answer: B

View Text Solution

25. On R, the set of real numbers, define a relation ~ as follows:

$a, b \in R$, a~b if $\{a\} = \{b\}$

Where $\{a\} = a - [a]$, and [a] = greatest integer $\leq a$. Then ~ is an equivalence relation on R. Which of the following is an equivalence class containing $\sqrt{2}$

A. $\left\{a+\frac{1}{\sqrt{2}+1}, a \in Q\right\}$

B. $\left\{m+\frac{1}{\sqrt{2}+1}, m \in Z\right\}$

C. $\{(\sqrt{2}a, a \in Q\}$

D. $\{\sqrt{2}m, m \in Z\}$

Answer: A

View Text Solution

Exercise Numerical Answer Type Questions

1. Let $f(x)=\tan^{-1}(\sqrt{x+7})+\sec^{-1}\left(\frac{1}{\sqrt{x(x+7)+1}}\right)$, then the range of contains ..... Elements.

Watch Video Solution

2. Let $f: R \to R$ be defined by

$f(x) = ax + b \forall x \in R$

Where $a, b \in R$ and $a \neq 1$

If $(fofofofof)(x)$= $32x + 93$, then value of b is .....

Watch Video Solution

3. Suppose A and B are two sets. If the power set of A contains 64 elements more than the power set of B, then number of elements in A is .....

View Text Solution

4. Let a, b, $c \in R$. If $f(x) = ax^2 + bx + c$ is such that $a + b + c = 3$ and $f(x + y) = f(x) + f(y) + xy, \forall x, y \in R,$ then $\sum_{n=1}^{10}$ is equal to

Watch Video Solution

5. Let $f(x) = \cos(\ln x), x > 0$. If

$f(xy) + f\left(\frac{x}{y}\right) = kf(x)f(y) \forall x, y > 0$ then k = ...

View Text Solution

6. Suppose A and B are two finite sets. If the number of relations that can be defined on A is 496 more than the number of relations that can be defined on B, then the number of elements is A =.....

View Text Solution

7. A class has 175 students. The following data shows the number of students obtaining one or more subjects. Mathematics 100, Physics 70, Chemistry 40, Mathematics and Physics 30, Mathematics and Chemistry 28, Physics and Chemistry 23, Mathematics, Physics and Chemistry 18. How many students have offered Mathematics alone (a) 35 (c) 60 (b) 48 (d) 22

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8. Let $f(x) = \sin(\ln x) \forall x > 0$. Suppose $f\left(e^{k\pi x}\right) = f(x) \forall x > 0$, then least value of k =.....

View Text Solution

9. The function f satisfies the functional equation $3f(x) + 2f\left(\frac{x+59}{x1}\right) = 10x + 30$ for all real $x \neq 1$. The value of $f(7) is$ 8 (b) 4 (c) -8 (d) 11

Watch Video Solution

10. Let [x] greatest integer $\leq x$. Define $f: R \to R$ by $f(x) = \cos(5x)\cos[5x] + \sin(5x)\sin[5x]$ then period of f is .....

Watch Video Solution

11. Let A and B be two finite sets such that $n(A) = 20, n(B) = 28$ and $n(A \cup B) = 36$, then find $n(A \cap B)$.

Watch Video Solution

12. Le A = {1,2, 3,4, 5}. Let {1,2,3} and {4, 5} be two equivalence classes of a relation R on A. The number of elements in R is .....

View Text Solution

13. Let A = {a, b, c,d). If an equivalence relation R on A has exactly one equivalence class, then number of elements in R is_____

View Text Solution

14. Let $f(x) = \cos^2 x + \cos^2(x + \pi/3) + \sin x \sin(x + \pi/3)$ and

$$g(x) = \begin{cases} 1 & \text{if } x < 5/4 \\ 2 & \text{if } 5/4 \leq x \leq 7/4 \\ 3 & \text{if } x > 7/4 \end{cases},$$

The number of elements in the range of $(gof)(x)$ is .....

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15. Let f be an even function defined on R. Suppose f is defined on [0,4] as follows:

$$f(x) = \begin{cases} 3x & \text{if} \quad 0 \leq x < 1 \\ 4 - x & \text{if} \quad 1 \leq x \leq 4 \end{cases}$$

and f satisfies the condition.

$$f(x - 2) = f\left\{x + \left[\frac{6x^2 + 272}{x^2 + 2}\right]\right) \forall x \in R$$

Where [x] = greatest integer $\leq x$. Then $f(3271) + f(-2052) + f(806)$

=.....

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16. Let $f: R - \{1\} \to R$ be defined by

$f(x) = \frac{1+x}{1-x} \forall x \in R - \{1\}$ then for $x \neq \pm 1$, $\frac{1+f(x)^2}{f(x)f(x^2)}$=.....

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17. Let $f: [0, \infty) \to R$ be such that

$f\left(\frac{16}{\sqrt{1+\sqrt{x}}}\right) = x \forall x \geq 0$, Then f(8)=

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18. Let $f: N \to R$ be a function satisfying the condition $f(1) + f(2)$ ..... $+ f(n) = n^2 f(n) \forall n \in N$

If $f(2025) = \frac{1}{2026}$, then f(1) = ...

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19. The number of integers lying in the range of $f(x) = \frac{15}{12 - 5\sin x}, x \in R$

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20. Let P be a polynomial satisfying the equation

$$P(x)P\left(\frac{1}{x}\right) = P(x) + P\left(\frac{1}{x}\right) \forall x > 0$$

If $P(2) = 33$, then P(3) =.....

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Question From Previous Years Aieee Jee Main Papers

1. 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

A. not symmetric

B. transitive

C. a function

D. reflexive

Answer: A

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2. The range of the function is $f(x) = {}^{7-x}P_{(x)-(x-3)}$ is

A. {1,2,3,4}

B. {1,2,3,4,5,6}

C. {1,2,3}

D. {1,2,3,4,5}

Answer: C

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3. The domain of the function $f(x) = \frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$, is

A. [1,2]

B. [2,3]

C. [0,3]

D. [-1,2]

Answer: B

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4. If $f: R \to S$, defined by $f(x) = \sin x - \sqrt{3}\cos x + 1$, is onto then the interval of S, is

A. [0,1]

B. [-1,1]

C. [0,3]

D. [1,2]

Answer: D

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5. If the graph of the function y = f(x) is symmetrical about the line x = 2, then

A. $f(x) = f(-x)$

B. $f(2+x) = f(2-x)$

C. $f(x+2) = f(x-2)$

D. $f(x) = -f(-x)$

Answer: B

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6. Let $R = \{(3,3),(6,6),(9,9),(6,12),(3,9),(3,12),(3,6)\}$ is a relation on set $A = \{3,6,9,12\}$ then R is

A. an equivalence relation

B. reflexive and symmetric only

C. reflexive and transitive only

D. reflexive only

Answer: C

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7. A ral valued functin $f(x)$ satisfies the functional equation $f(x-y) = f(x)f(y) - f(a-x)f(x+y)$ where 'a' is a given constant and $f(0) = 1$, $f(2a-x)$ is equal to :

A. $f(a) + f(a-x)$

B. $f(-x)$

C. $-f(x)$

D. $f(x)$

Answer: C

Watch Video Solution

8. 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. reflexive, not symmetric and transitive.

B. not reflexive, symmetric and transitive.

C. reflexive, symmetric and not transition.

D. reflexive, symmetric and transitive

Answer: C

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9. The largest interval lying in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ for which the function $\left[f(x) = 4^{-x} \hat{} 2 + \cos^{-1}\left(\frac{x}{2} - 1\right) + \log(\cos x)\right]$ is defined, is (1) $[0, \pi]$ (2) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (3) $\left[-\frac{\pi}{4}, \frac{\pi}{2}\right)$ (4) $\left[0, \frac{\pi}{2}\right)$

A. $\left(0, \frac{\pi}{2}\right)$

B. $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

C. $\left[-\frac{\pi}{4}, \frac{\pi}{2}\right)$

D. $\left[0, \frac{\pi}{2}\right)$

Answer: D

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10. 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? (1) neither S nor T is an equivalence relation on R (2) both S and T are equivalence relations on R

(3) S is an equivalence relation on R but T is not (4) T is an equivalence relation on R but S is not

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

B. Neither 5 nor T is an equivalence relation.

C. Both S and T are equivalence relation on R.

D. S is an equivalence relation but T is not.

Answer: A

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11. Let $f: N\overrightarrow{Y}$ be a function defined as $f(x) = 4x + 3$, where $Y = \{y \in N : y = 4x + 3 \text{ for some } x \in N\}$. Show that f is invertible and its inverse is (1) $g(y) = \frac{3y + 4}{3}$ (2) $g(y) = 4 + \frac{y + 3}{4}$ (3) $g(y) = \frac{y + 3}{4}$ (4) $g(y) = \frac{y - 3}{4}$

A. $g(x) = \frac{3y + 4}{3}$

B. $g(y) = 4 + \frac{y + 3}{4}$

C. $g(y) = \frac{y+3}{4}$

D. $g(y) = \frac{y-3}{4}$

Answer: D

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12. If A,B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$ then

A. B= C

B. $A \cap B = \phi$

C. A= B

D. A = C

Answer: A

Watch Video Solution

13. Consider the following relations: R = {(x, y) | x, y are real numbers and x = wy for some rational number w}; $S = \left\{ \left(\frac{m}{n}, \frac{p}{q} \right) \mathrm{m}, \mathrm{n}, \mathrm{pandqa\ r\ ei\ n\ t\ e\ g\ e\ r\ ss\ u\ c\ ht\ h\ a\ tn}, \mathrm{q} \neq 0 \mathrm{andq\ m} \right.$. Then (1) neither R nor S is an equivalence relation (2) S is an equivalence relation but R is not an equivalence relation (3) R and S both are equivalence relations (4) R is an equivalence relation but S is not an equivalence relation

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 5 is not an equivalence relation.

D. Neither R nor S is an equivalence relation.

Answer: A

Watch Video Solution

14. Let $X = \{1, 2, 3, 4, 5\}$. The number of different ordered pairs (Y, Z) that can be formed such that $Y \subseteq X$, $Z \subseteq X$ and $Y \cap Z$ is empty, is (1) 5^2 (2) 3^5 (3) 2^5 (4) 5^3

A. 2^5

B. 5^3

C. 5^2

D. 3^5

Answer: D

Watch Video Solution

15. Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of $A \times B$ having 3 or more elements is (1) 220 (2) 219 (3) 211 (4) 256

A. 211

B. 256

C. 220

D. 219

Answer: D

Watch Video Solution

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

A. reflexive and symmetric but not transitive.

B. reflexive and transitive but not symmetric.

C. symmetric and transitive but not reflexive.

D. an equivalence relation.

Answer: C

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17. Let $f(n) = \left[\frac{1}{3} + \frac{3n}{100}\right] n$, whre [x] denotes the greatest integer less than or equal to x. Then $\sum_{n=1}^{56} f(n)$ is equal to

A. 689

B. 1399

C. 1287

D. 56

Answer: B

View Text Solution

18. The function $f(x) = |\sin 4x| + \cos|2x|$ s a periodic function with period

A. $\pi/2$

B. 2π

C. π

D. $\pi/4$

Answer: A

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19. Let $f: R \to R$ be defined by $f(x) = \frac{|x|-1}{|x|+1}$ is

A. onto but not one-one

B. both one-one and onto

C. one-one but not onto

D. neither one-one nor onto

Answer: D

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20. 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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21. Let A and B be two sets containing four and two elements respectively. Then the number of subsets of the set $A \times B$, each having at least three elements is : (1) 219 (2) 256 (3) 275 (4) 510

A. 219

B. 256

C. 275

D. 510

Answer: A

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22. In a certain town 25% families own a phone and 15% own a car, 65% families own neither a phone nor a car, 2000 families own both a car and a phone . How many families live in the town ?

A. only (a) and (b) are correct

B. only (a) and (c) are correct

C. only (b) and (c) are correct

D. all (a), (b) and (c) are correct

Answer: D

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23. Let $A = \{x_1, x_2, x_3 \ldots . , x_7\}, B = \{y_1 y_2 y_3\}$. The total number of functions $f: A \to B$ that are onto and ther are exactly three elements x in A such that $f(x) = y_2$, is equal to

A. $(14)\left({}^7C_2\right)$

B. $(16)\left({}^7C_3\right)$

C. $(12)\left({}^{'7}C_2\right)$

D. $(14)\left({}^7C_3\right)$

Answer: D

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24. If $f(x) + 2f\left(\frac{1}{x}\right) = 3x, x \neq 0$ and

$S = \{x \in R: f(x) = f(-x)\}$, then S

A. is an empty set

B. contains exactly one element

C. contains exactly two elements

D. contains more than two elements

Answer: C

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25. If the function, $f: [1, \infty] \to [1, \infty]$ is defined by $f(x) = 3^{x^{x-1}}$, then $f^{-1}(x)$ is

A. $\frac{1}{2}\left(1 - \sqrt{1 + 4\log_3 x}\right)$

B. $\frac{1}{2}\left(1 - \sqrt{1 + 4\log_3 x}\right)$

C. $\frac{1}{2}\left(1 + \sqrt{1 + 4\log_3 x}\right)$

D. not defined

Answer: B

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26. For $x \in R, x \neq 0, 1,$ let $f_0(x) = \frac{1}{1-x}$ and $f_{n+1}(x) = f_0(f_n(x)), n = 0, 1, 2\ldots.$ Then the value of

$f_{100} + f_1\left(\frac{2}{3}\right) + f_2\left(\frac{3}{2}\right)$ is equal to

A. $\frac{8}{3}$

B. $\frac{4}{3}$

C. $\frac{5}{3}$

D. $\frac{1}{3}$

Answer: C

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27. The function $f: R \xrightarrow{-\frac{1}{2}, \frac{1}{2}}$ defined as $f(x) = \frac{x}{1+x^2}$, is : Surjective but not injective (2) Neither injective not surjective Invertible (4) Injective but not surjective

A. neither injective nor surjective

B. invertible

C. injective but not surjective

D. surjective but not injective

Answer: D

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28. Let a, b, $c \in R$. If $f(x) = ax^2 + bx + c$ is such that $a + b + c = 3$ and $f(x + y) = f(x) + f(y) + xy, \forall x, y \in R,$ then $\sum_{n=1}^{10}$ is equal to

A. 255

B. 330

C. 165

D. 190

Answer: B

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29. let $f(x) = 2^{10}x + 1$ and $g(x) = 3^{10}x + 1$. If $fog(x) = x$, then x is equal to

A. $\frac{3^{10} - 1}{3^{10} - 2^{-10}}$

B. $\frac{2^{10} - 1}{2^{10} - 3^{-10}}$

C. $\frac{1 - 3^{10}}{2^{10} - 3^{-10}}$

D. $\frac{1 - 2^{10}}{3^{10} - 2^{-10}}$

Answer: D

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30. The function $f: N \to N$ defined by $f(x) = x - 5\left[\frac{x}{5}\right]$ where N is a set of natural numbers, then

A. one-one and onto.

B. one-one but no onto.

C. onto but not one-one.

D. neither one-one nor onto.

Answer: C

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

A. 2^{18}

B. 2^{10}

C. 2^{15}

D. 2^{12}

Answer: C

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32. Let N denotes the set of all natural numbers. Define two binary relations on N as

$R_1 = \{(x, y) \in N \times N : 2x + y = 10\}$

$R_2 = \{(x, y) \in N \times N, x + 2y = 10\}$ Then

A. range of R_1 is {2,4,8}

B. range of R_2 is {1,2,3,4}

C. both R_1 and R_2 are symmetric relations

D. both R_1 and R_2 are transitive relations

Answer: B

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33. Consider the following two binary relations on the set $A = \{a, b, c\}$

$R_1 = \{(c, a), (b, b), (a, c), (c, c), (b, c), (a, a)\}$

$R_2 = \{(a, a), (b, a), (c, c), (b, a), (b, b), (a, c)\}$, Then

A. R_2 is symmetric but it is not transitive

B. both R_1 and R_2 are not symmetric

C. both R_1 and R_2 are transitive

D. R_1 is not symmetric but it is transitive

Answer: B

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34. Two sets A and B are as under $A = |(a, b) \in R \times R : |a - 5| < 1$ and $|b - 5| < 1\}B = [(a, b) \in R \times R$

(1) $B \subset A$ (2) $A \subset B$ (3) $A \cap B = \phi(anemptyset)(4) \neq itherA$ sub B n or B sub A`

A. $A \subset B$

B. $A \cap B = \phi$

C. neither $A \subset B$ nor $B \subset A$

D. $B \subset A$

Answer: A

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35. Let $S = \{x \in R : x \geq 0$ and $2|\sqrt{x} - 3| + \sqrt{x}(\sqrt{x} - 6) + 6 - 0\}$ Then S

A. contain exactly one element

B. contains exactly two elements

C. contain exactly four elements

D. in an empty set

Answer: A

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36. Let $f: A \to B$ be a function defined as $f(x) = \frac{x-1}{x-2}$, where $A = R - \{2)$ and $x - 2B = R - \{1\}$. Then f is:

A. invertible and $f^{-1}(y) = \frac{2y-1}{y-1}$

B. not invertible

C. invertible and $f^{-1}(y) = \frac{3y-1}{y-1}$

D. invertible and $f^{-1} = \frac{2y+1}{y-1}$

Answer: A

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37. For $x \in R - \{0, 1\}$, let $f_1(x) = \frac{1}{x}, f_2(x) = 1 - x$ and $f_3(x) = \frac{1}{1-x}$ be three given functions. If a function, J(x) satisfies $(f_2 \circ J \circ f_1)(x) = f_3(x)$, then $J(x)$ is equal to

A. $f_3(x)$

B. $f_1(x)$

C. $f_2(x)$

D. $\frac{1}{x} f_3(x)$

Answer: A

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38. Let $f(x) = a^x (a > 0)$ be written as $f(x) = f_1(x) + f_2(x)$, where $f_1(x)$ is an function and $f_2(x)$ is an odd function. Then $f_1(x + y) + f_1(x - y)$ equals

A. $2f_1(x)f_1(y)$

B. $2f_1(x+y)f_1(x-y)$

C. $2f_1(x)f_2(y)$

D. $2f_1(x+y)f_2(x-y)$

Answer: A

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39. Let $A = \{x \in R : x \text{ is not an integer}\}$ Define $f : A \to R$ as $f(x) = \frac{2x}{x-1} \forall x \in A$, then f is

A. injective but not surjective

B. not injective

C. surjective but not injective

D. neither injective nor surjectiv

Answer: A

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40. Let N be the set of numbers and two functions f and g be defined as

$f, g: N \to N$ such that

$$f(n) = \begin{cases} \frac{n+1}{2} & \text{if n is odd} \\ \frac{n}{2} & \text{if n is even} \end{cases}$$

and $g(n) = n - (-1)^n$. Then, fog is

A. both one-one and onto

B. one-one but not onto

C. neither one-one nor onto

D. onto but not one-one

Answer: D

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41. Let a function $f:(0,\infty)\to[0,\infty)$ be defined by $f(x)=\left|1-\frac{1}{x}\right|$. Then f is

A. not injective but it is surjective

B. injective only

C. neither injective nor surjective

D. both injective as well as surjective

Answer: C

Watch Video Solution

42. Let $f:R\to R$ be defined by $f(x)=\frac{x}{1+x^2}, x\in R$. Then, the range of f is

A. $\left[-\frac{1}{2},\frac{1}{2}\right]$

B. $R\sim[-1,1]$

C. $R\sim\left[-\frac{1}{2},\frac{1}{2}\right]$

D. $(-1, 1) \sim \{0\}$

Answer: A

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43. In a class 140 students numbered 1 to 140, all even numbered students opted Mathematics course, those whose number is divisible by 3 opted Physics course and those whose number is divisible by 5 opted Chemistry course. Then the number of students who did not opt for any of the three courses is (a) 38 (b) 1 (c)42 (d) 102

A. 102

B. 42

C. 1

D. 38

Answer: D

Watch Video Solution

44. Let $S = \{1, 2, 3, \ldots, 100\}$. The number of non-empty subsets A to S such that the product of elements in A is even is

A. $2^{50}\left(2^{50} - 1\right)$

B. $2^{100} - 1$

C. $2^{50} - 1$

D. $2^{50} + 1$

Answer: A

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45. If $f(x) = \log_e\left(\frac{1-x}{1+x}\right), |x| < 1, \quad \text{then} \quad f\left(\frac{2x}{1+x^2}\right)$ is equal to

A. $2f(x)$

B. $2f\left(x^2\right)$

C. $(f(x))^2$

D. $-2f(x)$

Answer: A

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46. If the function $f: R - \{1, -1\} \to A$ definded by $f(x) = \frac{x^2}{1-x^2}$, is surjective, then A is equal to

A. $R - \{-1]$

B. $[0, \infty)$

C. $R - [-1, 0]$

D. $R - (-1, 0)$

Answer: C

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47. The domain of the definition of the function

$f(x) = \frac{1}{4 - x^2} + \log_{10}(x^3 - x)$ is

A. $(-1, 0) \cup (1, 2) \cup (2, \infty)$

B. $(-2, -1) \cup (-1, 0) \cup (2, \infty)$

C. $(-1, 0) \cup (1, 2) \cup (3, \infty)$

D. $(1, 2) \cup (2, \infty)$

Answer: A

Watch Video Solution

48. Let $f(x) = x^2, x \in R.$ for any $A \subseteq R,$ " define " g(A)={x in R: f(x) in A}. " If " S=[0,4],` then which one of the following statements is not ture?

A. $g(f\{S)) \neq S$

B. $f(g(S)) = S$

C. $g(f(S)) = g(S)$

D. $f(g(S)) \neq f(S)$

Answer: C

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49. For $x \in \left(0, \frac{3}{2}\right)$, let $f(x) = \sqrt{x}, g(x) = \tan x$ and $h(x) = \frac{1-x^2}{1+x^2}$. If $\phi(x) = ((hof)og)(x)$, then $\phi\left(\frac{\pi}{3}\right)$ is equal to

A. $\tan(5\pi/3)$

B. $\tan(11\pi/12)$

C. $\tan(\pi/12)$

D. $\tan(7\pi/12)$

Answer: B

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50. Let A, B and C be sets such that $\phi \neq \cap B \subseteq C$. Then which of the following statements is not true?

A. If $A - C \subseteq B$, then $A \subseteq B$

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

C. If $A - B \subseteq C$ then $A \subseteq C$

D. $B \cap C \neq \phi$

Answer: A

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Questions From Previous Year S B Architecture Entrance Examination Papers

1. Let $f: (1 \to \infty) \to (1, \infty)$ be defined by $f(x) = \dfrac{x+2}{x-1}$. Then

A. f is 1 - 1 and onto

B. f is 1 - 1 but not onto

C. f is not 1 - 1 but onto

D. f is neither 1 - 1 nor onto

Answer: A

View Text Solution

2. Let $A = \{(x, y) : x > 0, y > 0, x^2 + y^2 = 1\}$ and let $B = \{(x, y) : x > 0, y > 0, x^6 + y^6 = 1\}$. The $A \cap B$

A. A

B. B

C. ϕ

D. $\{(0, 1), (1, 0)\}$

Answer: C

View Text Solution

3. A college warded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?

A. 7

B. 9

C. 11

D. 13

Answer: B

Watch Video Solution

4. Let Q be the set of all rational numbers and R be the relation defined as:

$R = \{(x, y) : 1 + xy > 0, x, y \in Q\}$

Then relation R is

A. symmetric and transitive

B. reflexive and transitive

C. an equivalence relation

D. reflexive and symmetric

Answer: D

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5. The domain of the function $f(x) = \frac{1}{3 - \log_3(x - 3)}$ is

A. $(-\infty, 30)$

B. $(-\infty, 30) \cup (30, \infty)$

C. $(3, 30) \cup (30, \infty)$

D. $(4, \infty)$

Answer: C

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6. Le $f: R \to R$ be a function defined by $f(x) = x^{2009} + 2009x + 2009$

Then f(x) is

A. one-one but not onto

B. not one-one but onto

C. neither one-one nor onto

D. one-one and onto

Answer: D

Watch Video Solution

7. Let f be a function defined on $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ by $f(x) = 3\cos^4 x - 6\cos^3 x - 3$ Then the range of $f(x)$ is

A. $[-12, -3]$

B. $[-6, -3]$

C. $[-6, 3)$

D. $(-12, 3]$

Answer: A

View Text Solution

8. Consider the following relations

$R_1 = \{(x, y) : x$ and y are integers and x=ay or y=ax for some integer a}

$R_2 = \{(x, y) : x$ and y are integers and $ax + by = 1$ for some integers a,b}, Then

A. R_1, R_2 are not equivalence relations

B. R_1, R_2 are equivalence relations

C. R_2 is an equivalence relation but R_1 is not

D. R_2 is an equivalence relation but R_2 is not

Answer: D

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9. Let f and g be functions defined by $f(x) = \frac{1}{x+1}, x \in R, x \neq -1$ and $g(x) = x^2 = 1, x \in R$. Then g.f is

A. one-one but not onto

B. onto but not one-one

C. both one-one and onto

D. neither one-one nor onto

Answer: D

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10. 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. max {b,c}

B. min {b,c}

C. bc

D. b+c

Answer: C

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11. Let f(x) = $(x+1)^2 - 1, (x \geq -1)$. Then, the set S = {x : f(x) = $f^{-1}(x)$} is

A. is an empty set

B. contains exactly one element

C. contains exactly two elements

D. contains more than two elements

Answer: C

Watch Video Solution

12. Let $f: R \to R$ be a function defined by, $f(x) = \frac{e^{|x|} - e^{-x}}{e^{x} + e^{-x}}$ then

A. one-one and onto

B. one-one but not onto

C. onto but not one-one

D. neither onto nor one-one

Answer: D

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13. If f is a function of real variable x satisfying $f(x+4)-f(x+2)+f(x)=0$, then f is periodic function with period:

A. 8

B. 10

C. 12

D. 6

Answer: C

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14. If A and B are two finite sets such that the total number of subsets of A is 960 more the total number of subsets of B, then $n(A)-n(B)$ is equal to .

A. 2

B. 3

C. 4

D. 6

Answer: C

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15. If $f(x) + 2f(1-x) = x^2 + 1,\ \forall x \in R$, then the range of f is :

A. $(-\infty, 1/3]$

B. $[-1/3, 1/3]$

C. $[-1/3, \infty)$

D. $[1/3, \infty)$

Answer: C

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16. The function $f(x) = \frac{x}{1+|x|}$ is

A. onto but not one-one

B. neither one-one nor onto

C. one-one and onto

D. one-one but not onto

Answer: D

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17. In a survey it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 people liked products A and B, 12 people liked products C and A, 14 people liked products B and C and 8 liked all the three products. Find h

A. 4

B. 6

C. 11

D. 15

Answer: C

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18. Let R be a relation over the set $N \times N$ and it is defined by $(a, b)R(c, d) \Rightarrow a + d = b + c$. Then R is

A. reflexive but neither symmetric nor transitive.

B. symmetric but neither reflexive nor transitive.

C. transitive but neither reflexive nor symmetric

D. symmetric and transitive but not reflexive

Answer: B

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19. The number of elements in the set $A \cap B \cap C$, where

$A = \{(x, y) \in R \times R, |x| + |y| \geq 1\}$

$B = \{(x, y) \in R \times R, x^2 + y^2 \geq 1\}$

and $C = \{(x, y) \in R \times R: \max |x|, |y| = 1\}$ is:

A. 1

B. 2

C. 4

D. infinitely many

Answer: C

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