MATHS

JEE MAINS & ADVANCED

CLASS - XII

MODULE – 01

Relations & Function | Inverse Trigonometric Functions | Continuity & Differentiability, Methods of Differentiation | Application of Derivatives

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EXERCISE-I

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RELATIONS

Q.1 The relation R defined in N as aRb $\Leftrightarrow$ b is divisible by a is
(1) Reflexive but not symmetric
(2) Symmetric but not transitive
(3) Symmetric and transitive
(4) None of these

Q.2 If A is the set of even natural numbers less than 8 and B is the set of prime numbers less than 7, then the number of relations from A to B is
(1) 2^9 (2) 9^2
(3) 3^2 (4) 2^{9-1}

Q.3 Let R be a reflexive relation on a set A and I be the identity relation on A. Then
(1) $R \subset I$ (2) $I \subset R$
(3) $R = I$ (4) $R = 2I$

Q.4 The relation "is subset of" on the power set P(A) of a set A is
(1) Symmetric
(2) Anti-symmetric
(3) Equivalency relation
(4) Reflexive

Q.5 Let R be a relation over the set N × N and it is defined by $(a,b)R(c,d) \Rightarrow a+d=b+c.$ Then R is
(1) Reflexive only
(2) Symmetric only
(3) Transitive only
(4) An equivalence relation

Q.6 The number of reflexive relations of a set with four elements is equal to
(1) 2^{16} (2) 2^{12}
(3) 2^8 (4) 2^4

Q.7 Let R be a relation on the set N of natural numbers defined by nRm $\Leftrightarrow$ n is a factor of m (i.e., n|m). Then R is
(1) Reflexive and symmetric
(2) Transitive and symmetric
(3) Equivalence
(4) Reflexive, transitive but not symmetric

FUNCTION

Domain and Co-domain and Range

Q.8 The domain of $\sin^{-1}(\log_3 x)$ is
(1) [0, 1] (2) [0, ∞]
(3) R (4) [1/3, 3]

Q.9 Domain of the function $\sqrt{2-x}-\frac{1}{\sqrt{9-x^2}}$ is
(1) (–3, 1) (2) [–3, 1]
(3) (–3, 2] (4) [–3, 1)

Q.10 Range of the function $f(x)=\frac{x^2+x+2}{x^2+x+1}; x \in R$ is
(1) (1, ∞) (2) (1, 11/7]
(3) (1, 7/3] (4) (1, 7/5]

Types of Function

Q.11 Mapping $f: R \to R$ which is defined as $f(x)=\cos x, x \in R$ will be
(1) Neither one-one nor onto
(2) One-one
(3) Onto
(4) One-one onto

Q.12 Let $f: R \to R$ be a function defined by $f(x)=\frac{x-m}{x-n}$ where $m \neq n$. Then
(1) f is one-one onto
(2) f is one-one into
(3) f is many one onto
(4) f is many one into

Q.13 Let $f(x)=\frac{x^2-4}{x^2+4}$ for $|x|>2$, then the function $f:(-\infty,-2]\cup[2,\infty)\to(-1,1)$ is
(1) One-one into (2) One-one onto
(3) Many one into (4) Many one onto

Q.14 If $f: R \to S$ defined by $f(x)=\sin x-\sqrt{3}\cos x+1$ is onto, then the interval of S is
(1) [–1, 3] (2) [1, 1]
(3) [0, 1] (4) [0, –1]

Q.15 If R denotes the set of all real numbers then the function $f: R \to R$ defined $f(x)=[x]$
(1) One-one only
(2) Onto only
(3) Both one-one and onto
(4) Neither one-one nor onto

Identical Function & Functional Equation.

Q.16 Let $f(\theta) = \sin\theta(\sin\theta + \sin 3\theta)$. Then $f(\theta)$-
(1) ≥ 0 only when $\theta \geq 0$
(2) ≤ 0 for all real θ
(3) ≥ 0 for all real θ
(4) ≤ 0 only when $\theta \leq 0$

Q.17 If $f(x) = \frac{x}{x-1}$, then $\frac{f(a)}{f(a+1)} =$

(1) $f(-a)$ (2) $f\left(\frac{1}{a}\right)$

(3) $f(a^2)$ (4) $f\left(\frac{-a}{a-1}\right)$

Q.18 If $f(x) = \cos(\log x)$,

then $f(x^2)f(y^2) - \frac{1}{2}\left[f\left(\frac{x^2}{2}\right) + f\left(\frac{x^2}{y^2}\right)\right]$ has the value

(1) $\frac{1}{2}\left[\cos\log y^2 - \cos\log\frac{1}{2}\right]$

(2) $\frac{1}{2}\left[\cos\log x^2y^2 + \cos\log\frac{x^2}{2}\right]$

(3) $\cos\log x^2y^2 - \cos\log\frac{x^2}{2}$

(4) $\frac{1}{2}\left[\cos\log x^2y^2 - \cos\log\frac{x^2}{2}\right]$

Q.19 If $\phi(x) = a^x$, then $\{\phi(p)\}^3$ is equal to
(1) $\phi(3p)$ (2) $3\phi(p)$
(3) $6\phi(p)$ (4) $2\phi(p)$

Composite function

Q.20 If $f(x) = \frac{\alpha x}{x+1}$, $x \neq -1$. Then, for what value of α is $f(f(x)) = x$
(1) $\sqrt{2}$ (2) $-\sqrt{2}$
(3) 1 (4) -1

Q.21 Let $g(x) = 1 + x - [x]$ and $f(x) = \begin{cases} -1, & \text{If } x < 0 \\ 0, & \text{If } x = 0, \text{ then} \\ 1, & \text{if } x > 0 \end{cases}$

for all values of x the value of $fog(x)$
(1) x (2) 1
(3) $f(x)$ (4) $g(x)$

Even and Odd Function

Q.22 Let the function $f(x) = 3x^2 - 4x + 8\log(1 + |x|)$ be defined on the interval [0, 1]. The even extension of f(x) to the interval [–1, 0] is -
(1) $3x^2 + 4x + 8\log(1 + |x|)$
(2) $3x^2 - 4x + 8\log(1 + |x|)$
(3) $3x^2 + 4x - 8\log(1 + |x|)$
(4) $3x^2 - 4x - 8\log(1 + |x|)$

Q.23 If $f(x) = 2x^6 + 3x^4 + 4x^2$ then $f'(x)$ is
(1) Even function
(2) An odd function
(3) Neither even nor odd
(4) both even-odd

Q.24 Which of the following function is even function

(1) $f(x) = \frac{a^x + 1}{a^x - 1}$ (2) $f(x) = x\left(\frac{a^x - 1}{a^x + 1}\right)$

(3) $f(x) = \frac{a^x - a^{-x}}{a^x + a^{-x}}$ (4) $f(x) = \sin x$

Q.25 If $f(x) = \log\frac{1+x}{1-x}$, then $f(x)$ is
(1) Even function
(2) $f(x_1)f(x_2) = f(x_1 + x_2)$
(3) $\frac{f(x_1)}{f(x_2)} = f(x_1 - x_2)$
(4) Odd function

Q.26 The function $f(x) = \log(x + \sqrt{x^2 + 1})$, is
(1) An even function
(2) An odd function
(3) A Periodic function
(4) Neither an even nor odd function

Periodic function

Q.27 If $f : R \to R$ is a function satisfying the property $f(x+1) + f(x+3) = 2\ \forall\ x \in R$ then the period (may not be fundamental period) of $f(x)$ is
(1) 3 (2) 4
(3) 7 (4) 6

Q.28 If $f(x) = \cos(ax) + \sin(bx)$ is periodic, then which of the followings is false -
(1) a and b both are rational
(2) non-periodic if a is rational but b is irrational
(3) non-periodic if a is irrational but b is rational
(4) none of these

Q.29 Function $f(x) = \sin x + \tan x + \text{sgn}(x^2 - 6x + 10)$ is
(1) periodic with period 2π
(2) periodic with period π
(3) non-periodic
(4) periodic with period 4π

Q.30 The period of $f(x) = x - [x]$, if it is periodic, is
(1) $f(x)$ is not periodic (2) $\frac{1}{2}$
(3) 1 (4) 2

Inverse of function

Q.31 If $f(x) = x^3 - 1$ and domain of $f = \{0,1,2,3\}$, then domain of f^{-1} is -
(1) $\{0,1,2,3\}$ (2) $\{1,0,-7,-26\}$
(3) $\{-1,0,7,26\}$ (4) $\{0,-1,-2,-3\}$

Q.32 The inverse of the function $y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$ is
(1) $\frac{1}{2}\log\frac{1+x}{1-x}$ (2) $\frac{1}{2}\log\frac{2+x}{2-x}$
(3) $\frac{1}{2}\log\frac{1-x}{1+x}$ (4) $2\log(1+x)$

Miscelloneous

Q.33 The function $f(x) = \sqrt{\log_{10}\cos(2\pi x)}$ exists -
(1) for any rational x
(2) only when x is a positive integer
(3) only when x is fractional
(4) for any integer value of x including zero

Q.34 Let A = N × N and * be the binary operation on A defined by (a, b) * (c, d) = (a + c, b + d). Find the identity element for * on A, if any.
(1) 1 (2) 2
(3) 3 (4) does not exists

Q.35 Number of binary operations on the set {a, b} are
(1) 2 (2) 2^2
(3) 2^3 (4) 2^4

EXERCISE-II

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RELATIONS

Q.1 Let R be a reflexive relation on a set A and *I* be the identity relation on A. Then
(1) $R \subset I$ (2) $I \subset R$
(3) $R = I$ (4) $R = 2I$

Q.2 R is a relation over the set of real numbers and it is given by $nm \geq 0$. Then R is
(1) Symmetric and transitive
(2) Reflexive and symmetric
(3) A partial order relation
(4) An equivalence relation

Q.3 Let S be the set of all real numbers. Then the relation $R = \{(a, b) : 1 + ab > 0\}$ on S is
(1) Reflexive and symmetric but not transitive
(2) Reflexive and transitive but not symmetric
(3) Symmetric, transitive but not reflexive
(4) Reflexive, transitive and symmetric

Q.4 Let $R = \{(3,3),(6,6),(9,9),(12,12),(6,12),(3,9),(3,12),(3,6)\}$, be relation on the set $A = \{3, 6, 9, 12\}$. The relation is
(1) reflexive and transitive only
(2) reflexive only
(3) an equivalence relation
(4) reflexive and symmetric only

Q.5 Let W denote the words in the English dictionary. Define the relation Rby : $R = \{(x, y) \in W \times W \mid$ the words x and y have at least one letter in common$\}$. Then R is –
(1) reflexive, symmetric and not transitive
(2) reflexive, symmetric and transitive
(3) reflexive, not symmetric and transitive
(4) not reflexive, symmetric and transitive

Q.6 Let R and S be two non-void relations on a set A. Which of the following statements is false
(1) R and S are transitive $\Rightarrow R \cup S$ is transitive
(2) R and S are transitive $\Rightarrow R \cap S$ is transitive
(3) R and S are symmetric $\Rightarrow R \cup S$ is symmetric
(4) R and S are reflexive $\Rightarrow R \cap S$ is reflexive

ABOUT PHYSICS WALLAH

Alakh Pandey is one of the most renowned faculty in NEET & JEE domain's Physics. On his YouTube channel, Physics Wallah, he teaches the Science courses of 11th and 12th standard to the students aiming to appear for the engineering and medical entrance exams.

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