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-III

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Q.1 For the function $f(x) = \ell n (\sin^{-1} \ell og_2 x)$,

(A) Domain is $\left[\frac{1}{2}, 2\right]$ (B) Range is $\left(-\infty, \ell n\frac{\pi}{2}\right]$

(C) Domain is $(1, 2]$ (D) Range is R

Q.2 Let $D \equiv [-1, 1]$ is the domain of the following functions, state which of them are injective.

(A) $f(x) = x^2$ (B) $g(x) = x^3$

(C) $h(x) = \sin 2x$ (D) $k(x) = \sin(\pi x/2)$

Q.3 Let $f : I \to R$ (where I is the set of positive integers) be a function defined by $f(x) = \sqrt{x}$, then f is:

(A) one – one (B) many one

(C) onto (D) into

Q.4 If $f: R \to [-1, 1]$, where $f(x) = \sin\left(\frac{\pi}{2}[x]\right)$, (where [.] denotes the greatest integer function), then

(A) f (x) is onto (B) f (x) is into

(C) f (x) is periodic (D) f (x) is many one

Q.5 Let $f : [-1, 1] \to [0, 2]$ be a linear function which is onto, then f(x) is/are

(A) $1 - x$ (B) $1 + x$

(C) $x - 1$ (D) $x + 2$

Q.6 If 'f' and 'g' are bijective functions and gof is defined then gof must be

(A) injective (B) surjective

(C) bijective (D) into only

Q.7 If $f : R \to [-1, 1]$, where $f(x) = \sin \pi/2 [x]$, (where $[*]$ dentoes the greatest integer function) then

(A) f(x) is onto (B) f(x) is into

(C) f(x) is periodic (D) f(x) is many one

Q.8 Let $f : R - \left\{\frac{1}{5\sqrt{2}}\right\} \to R - \left\{\frac{1}{5\sqrt{2}}\right\}$ be a function defined as $f(x) = \left(\frac{x - 2\sqrt{5}}{5\sqrt{2}x - 1}\right)$ then which of the following is(are) **CORRECT**?

(A) $f\left(f\left(f\left(f(2017)\right)\right)\right) = 2017$

(B) $f(x) = f^{-1}(x)$ has more than 3 real roots

(C) f (x) is a bijective function

(D) $f\left(f\left(f(x)\right)\right) = f\left(f\left(f\left(f\left(f(x)\right)\right)\right)\right) \forall x \neq \frac{1}{5\sqrt{2}}$

Q.9 Let $f(x) = \left(\frac{1-x}{1+x}\right), 0 \le x \le 1$ and $g(x) = 4x(1-x), 0 \le x \le 1$, then

(A) $fog = \frac{1 - 4x + 4x^2}{1 + 4x - 4x^2}, 0 \le x \le 1$

(B) $fog = \frac{1 - 4x - 4x^2}{1 + 4x - 4x^2}, \frac{1}{2} \le x \le 1$

(C) $gof = \frac{8x(1-x)}{(1+x)^2}, 0 \le x \le 1$

(D) $gof = \frac{8x(1+x)}{(1+x)^2}, 0 \le x \le 1$

Q.10 Which of following pairs of functions are identical.

(A) $f(x) = e^{\ell n \sec^{-1} x}$ and $g(x) = \sec^{-1} x$

(B) $f(x) = \tan(\tan^{-1} x)$ and $g(x) = \cot(\cot^{-1} x)$

(C) $f(x) = sgn(x)$ and $g(x) = sgn(sgn(x))$

(D) $f(x) = \cot^2 x . \cos^2 x$ and $g(x) = \cot^2 x - \cos^2 x$

Comprehension # 1 (Q. No. 11 to 13)

Let $f(x) = \frac{x^3}{3} + \frac{x^2}{2} + ax + b \quad \forall x \in R$

Q.11 Least value of 'a' for which f(x) is injective function, is

(A) $\frac{1}{4}$ (B) 1

(C) $\frac{1}{2}$ (D) $\frac{1}{8}$

Q.12 If $a = -1$, then f(x) is

(A) bijective (B) many–one and onto

(C) one–one and into (D) many– one and into

Q.13 f(x) is invertible iff

(A) $a \in \left[\frac{1}{4}, \infty\right), b \in R$ (B) $a \in \left[\frac{1}{8}, \infty\right), b \in R$

(C) $a \in \left(-\infty, \frac{1}{4}\right], b \in R$ (D) $a \in \left(-\infty, \frac{1}{4}\right), b \in R$

Comprehension # 2 (Q. No. 14 to 16)

Consider the function $f(x) = \begin{cases} x^2 - 1, & -1 \le x \le 1 \\ \ell nx, & 1 < x \le e \end{cases}$

Let $f_1(x) = f(|x|)$

$f_2(x) = |f(|x|)|$

$f_3(x) = f(-x)$

Now answer the following questions.

Q.14 Number of positive solution of the equation $2f_2(x) - 1 = 0$ is (are)
(A) 4 (B) 3
(C) 2 (D) 1

Q.15 Number of integral solution of the equation $f_1(x) = f_2(x)$ is (are)
(A) 1 (B) 2
(C) 3 (D) 4

Q.16 If $f_4(x) = \log_{27}(f_3(x) + 2)$, then range of $f_4(x)$ is
(A) $[1, 9]$ (B) $\left[\frac{1}{3}, \infty\right)$
(C) $\left[0, \frac{1}{3}\right]$ (D) $[1, 27]$

Q.17 Match the column :

Column – I	**Column – II**
(A) The period of the function $y = \sin(2\pi t + \pi/3) + 2\sin(3\pi t + \pi/4) + 3\sin 5\pi t$	(p) 1/2
(B) $y = \{\sin(\pi x)\}$ is a many one function for $x \in (0, a)$, where $\{x\}$ denotes fractional part of x, then a may be	(q) 8
(C) The fundamental period of the function $y = \frac{1}{2}\left(\frac{\lvert\sin(\pi/4)x\rvert}{\cos(\pi/4)x} + \frac{\sin(\pi/4)x}{\lvert\cos(\pi/4)x\rvert}\right)$	(r) 2
(D) If $f: [0, 2] \to [0, 2]$ is bijective function defined by $f(x) = ax^2 + bx + c$, where a, b, c are non-zero real numbers, then f(2) is equal to	(s) 0

Q.18 Let $f(x) = \sin^{-1} x$, $g(x) = \cos^{-1} x$ and $h(x) = \tan^{-1} x$. For what interval of variation of x the following are true.

Column – I	**Column – II**
(A) $f\left(\sqrt{x}\right) + g\left(\sqrt{x}\right) = \pi/2$	(p) $[0, \infty)$
(B) $f(x) + g\left(\sqrt{1-x^2}\right) = 0$	(q) $[0, 1]$
(C) $g\left(\frac{1-x^2}{1+x^2}\right) = 2h(x)$	(r) $(-\infty, 1)$
(D) $h(x) + h(1) = h\left(\frac{1+x}{1-x}\right)$	(s) $[-1, 0]$

NUMERICAL VALUE BASED

Q.19 Let f be a function satisfying $2f(x) - 3f(1/x) = x^2$ for any $x \neq 0$, then absolute value of f(2) is

Q.20 If $f(x) + f(x+4) = f(x+2) + f(x+6)\ \forall x \in R$, and $f(5) = 10$, then $\sum_{r=1}^{100} f(5 + 8r)$ equal to

Q.21 Absolute value of the parameter α, for which the function $f(x) = 1 + \alpha x$, $\alpha \neq 0$ is the inverse of itself, is

Q.22 If $f''(x) = -f(x)$ and $g(x) = f'(x)$ and $F(x) = \left(f\left(\frac{x}{2}\right)\right)^2 + \left(g\left(\frac{x}{2}\right)\right)^2$ and given that F(5) = 5, then F(10) is equal to

Q.23 If f(x) is a function that is odd and even simultaneously, then f(3) – f(2) is equal to

Q.24 If f is a function such that f(0) = 2, f(1) = 3 and f(x + 2) = 2f(x) – f(x + 1) for every real x then f(5) is

Q.25 An odd function is symmetric about the vertical line x = a (a > 0) and if $\sum_{r=0}^{\infty}[f(1+4r)]^r = 8$, then find the value of f(1).

Q.26 Let $f: R \to R$ such that
$f(x - f(y)) = f(f(y)) + x f(y) + f(x) - 1\ \forall x, y \in R$.
Then find the value of $|(f(16))| - 125$.

Q.27 The function f satisfies the functional equation $3f(x) + 2f\left(\frac{x+59}{x-1}\right) = 10x + 30$ for all real $x \neq 1$. The value of f(7) is equal to

Q.28 The total number of solutions of $[x]^2 = x + 2\{x\}$, where [.] and {.} denote the greatest integer and the fractional part functions, respectively, is equal to

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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