SINGLE OPTION CORRECT

1. If $f(x)=\prod_{k=1}^{999}\left(x^2-47x+k\right)$ then product of all real roots of f(x) = 0.
(A) 550! (B) 551! (C) 552! (D) 999!

2. A real valued function f satisfying the equation f(x) + 2f (– x) = x^2 – x, then sum of real roots of equation f(f(x)) = 0 is
(A) - 3 (B) - 6 (C) - 9 (D) – 10

3. The function f:R →(1, ∞) is defined by f(x) = $9^{|x|}$ + (1 + sgn(x))9^x is
(A) one-one and onto (B) Many-one and Onto (C) Many-one and into (D) One-One and onto

4. If f(x) is defined for [-1, 2] then the domain of f([x] – x^2 + 4) is where [.] is GIF
(A) [- √3, √3] (B) [- √3, √7] (C) [- √3, 1] ∪ [√3, √7] (D) [- √3, - 1] ∪ [√3, √7]

5. The function f(x) = $\sqrt{\log_{x^2} x}$ is defined for x belonging to –
(A) (- ∞, 0) (B) (0, 1) (C) (1, ∞) (D) (0, ∞)

6. Let f (x) be a differentiable function everywhere and satisfies relation
f(x + y) + f(x) + f(y) = 2f(x - y) + 6xy - 4 y ∀ x, y ∈ R and f (0) = -1, then
(A) f (x) is an even function (B) f (x) is an odd function
(C) f(1) = 1 (D) f(0), f′(4) & f(4) are in A.P.

7. If {x} represents the fractional part of x, then $\left\{\frac{5^{200}}{8}\right\}$ is
(A) 1/4 (B) 1/8 (C) 3/8 (D) 5/8

8. Let f(x) = tan x and $g(f(x))=f\left(x-\frac{\pi}{4}\right)$, where f(x) and g(x) are real values functions for all possible value of x, then f(g(x)) is
(A) $\tan\left(\frac{x-1}{x+1}\right)$ (B) tan(x - 1) – tan(x + 1) (C) $\frac{f(x)+1}{f(x)-1}$ (D) $\frac{x-\frac{\pi}{4}}{x+\frac{\pi}{4}}$

9. If f(x) = tanx + $\tan^2x$ tan2x and $g(n)=\sum_{r=0}^{n} f\left(2^r\right)$, then g(2013) – tan($2^{2014}$) is equal to
(A) 0 (B) tan(1) (C) - tan(1) (D) 1

10. If [x] and {x} denotes the greatest integer and fractional part function, then the number of real x, satisfying the equation (x – 2)[x] = {x} – 1, is
(A) 0 (B) 1 (C) 2 (D) infinite

11. The number of real solution of $6^x + 1 = 8^x - 27^{x-1}$ is/are
(A) exactly one (B) Exactly two (C) more than two (D) None of these

12. If [$x^3 + x^2 + x + 1$] = [$x^3 + x^2 + 1$] + x, (where [.] denote the greatest integer function), then number of solutions of the equation $\log_e$|[x]| = 2 – |[x]| is
(A) 1 (B) 0 (C) 3 (D) 2

SECTION -III

This section contains **1 paragraph of 3 questions,** Each question has **FOUR** options (A), (B), (C) and (D) **ONE OR MORE THAN ONE** of these four option(s) is(are) correct. (*Marking scheme*)

+4 If only the bubble(s) corresponding to all the correct response
0 In none of the bubbles is darkened
–2 In all other cases

If $f : X \to Y$ be a function defined by $y = f(x)$ such that f is both one-one and onto then there exists a unique function $g : Y \to X$ such that for each $y \in Y$, $g(y) = x$ iff $y = f(x)$. The function g so defined is called the inverse of f and denoted as $f^{-1}(x) = g(x)$.

1. Consider $f : X \to Y$, $g : Y \to X$ two invertible functions such that $f^{-1}(x) = g(x)$, then
   (A) $f(g(x)) = I(x)$, where I(x) = Identity function on X.
   (B) $(fog)^{-1}(x) = I(y)$, Where I(y) = Identity function on Y.
   (C) $\dfrac{g(x_2)-g(x_1)}{x_2-x_1}$ = May be 4 where x_1, x_2 satisfy the equation f(x) = g(x).
   (D) Let $h:(1,2]\to(0,\sqrt{3}], h(x)=\sqrt{x^2-1}$ & $P:\left[-1,2^{\frac{1}{8}}\right]\to\left[-1,2^{\frac{7}{8}}\right], P(x)=x^7$ then domain of $(hoP)(x)$ is $\left(1,2^{\frac{1}{8}}\right]$.

2. If $f:\left[\dfrac{3\pi}{2},2\pi\right]\to[-1,0]$, where f(x) = sinx then $f^{-1}(x)$ can Not be
   (A) $\dfrac{3\pi}{2}+\sin^{-1}x$ (B) $2\pi+\sin^{-1}x$ (C) $3\pi-\sin^{-1}x$ (D) $\dfrac{5\pi}{2}-\sin^{-1}x$

3. A function $f : I \to J$ given by $f(i) = j$ where I = {0,1,2,….9} , J = {0,1,2, ….100} and i, j are element of set I, J respectively. Then number of bijective functions of type $f : I \to B$ where $B \subseteq J$ and f(5) = 5 is
   (A) ${}^{100}C_9 10!$ (B) ${}^{100}C_9 .9!$ (C) ${}^{101}C_{10} 10!$ (D) none of these

MULTI OPTION(S) CORRECT

1. Let $\alpha(n)=1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\cdots\cdots+(-1)^{n-1}\frac{1}{n}$, then
   (A) $\frac{1}{n+1}+\frac{1}{n+2}+\frac{1}{n+3}+\cdots\cdots\cdots+\frac{1}{2n}=\alpha(2n)$ (B) $\alpha(2n)<1\,\forall n$
   (C) $\alpha(2n)\ge 0.5\,\forall n$ (D) $0.5<\alpha(n)<1\,\forall n$

2. Let f: R→R, g: R→R and h: R→R be differentiable function such that $f(x) = x^3 + 2x + 1$, g (f(x)) = x and h (g (g(x))) = x ∀ x∈R. Then
   (A) g′ (1) = 1/2 (B) h′ (0) = 10
   (C) If $x_0 \in R$, $x_0^3 + 2x_0 - 2 = 0$ then $h(x_0) = 34$ (D) h (g (2)) = 12

3. $f(x)=\begin{cases}x+a, & x\ge 0\\ 2-x, & x<0\end{cases}$ and $g(x)=\begin{cases}\{x\}, & x<0\\ b+\sin x, & x\ge 0\end{cases}$
   If f (g(x)) is continuous at x = 0, then which of the following is/are true (where {x} represents fractional part function)
   (A) If b = 1, then 'a' can take any real value (B) b < - 1, is not possible
   (C) No values of a and b are possible (D) There exist finite ordered pairs (a, b)

4. If f: R →R, such that f(x + y) + f(x - y) = 2f(x) f(y) $\forall x, y \in R$, then
   (A) f(x) is even function if $f(0) \neq 0$.
   (B) f(x) is odd function if $f(0) \neq 0$.
   (C) f(x) is both even and odd if f(0) = 0.
   (D) f(x) is neither even nor odd if f(0) = 0.

INTEGER OPTION TYPE (0 - 9)

1. Let A = {1, 2, 3, 4, 5}. If be a bijective function from A → A and number of such functions for which f(k) ≠ k; ∀ k ∈ A, is 11p, then value of p is___________

2. Consider $f(x) = x\sin\left([x]^4 - 5[x]^2 + 4\right)$, then number of points in (-5, 5) where $\lim_{x\to a} f(x) = \text{D.N.E.}$ & $a \in (-5, 5)$?

3. Find the number of integral values of x in [- π, π] which satisfies the domain of $f(x) = \sqrt{\log_2\left(4\sin^2 x - 2\sqrt{3}\sin x - 2\sin x + \sqrt{3} + 1\right)}$

4. If f(x) = x ln(2x) –x, where $x \in \left[\frac{1}{2e}, \frac{e}{2}\right]$ and range of f(x) is $\left[-\frac{1}{a}, b\right]$ then value of a + b is

5. The number of integral values of x satisfying $\sqrt{-x^2 + 10x - 16} < x - 2$ is _____

6. $f(x) + f\left(\frac{1}{1-x}\right) = \frac{2(1-2x)}{x(1-x)}$, where x is a real number x ≠ 0, x ≠ 1, then the value of f(2) must be __

7. If the number of the positive integral solutions of the equation $\left[\frac{x}{9}\right] = \left[\frac{x}{11}\right]$ is n, then $\frac{n}{3}$ is_____ (where [.] is GIF)

8. f is a function such that f (x) + 2 f (1 - x) = x^2 + 1 . The value of f (3) is ___

9. If x ∈ (- 1, 0) and f(x) = $\frac{1 + x + \sqrt{1 + x^2}}{1 - x + \sqrt{1 + x^2}}$, then number of solutions of cot(f(x)) = 4 is ___

10. If $x^5 - x^3 + x = a$, when x > 0, then the maximum value of $2a - x^6$ is equal to _____

11. Number of solutions of the equation $f(x) - f^{-1}(x) = 0$ is/are, when $f(x) = \begin{cases} 1 - \frac{x}{3}, & x \le 0 \\ 1 - x^2, & x > 0 \end{cases}$ ___

12. If $f(x) = 2x^3 - 3x^2 + 1$ then number of distinct real solution(s) of the equation f(f(x)) = 0 is/are ____

MATRIX MATCH TYPE

1. Match the following Column – I with Column - II

	COULUMN - I		COULUMN - II
A	Range of $f(x)=\sqrt{x-1}+2\sqrt{3-x}$ is	P	$\left[\frac{3}{2},\infty\right)-\{3\}$
B	The superset(s) of domain of function ([.] =G.I.F. & |.|= Modulus) $f(x)=\log_{\left[x+\frac{1}{2}\right]}\left(\lvert x^2-x-6\rvert\right)+\left[\sqrt{x-1}\right]-3\sqrt{\sqrt{19}-\sqrt{2x}}$ is/are	Q	$\left[\frac{3}{2},\frac{5}{2}\right)$
C	A function f(x) is defined for $\forall x\in(-1,8]$, then domain of function $g(x)=f\left(x^2\right)+f\left(\sqrt{x-\sqrt{2}}\right)$ is a subset of	R	$\left[\sqrt{2},\sqrt{10}\right]$
D	Exactly one root of the equation $2(x-1)^3-9(x-1)^2+12x-16=0$ lies in the interval	S	$\left[\sqrt{2},2\sqrt{2}\right]$

2. Match the following

	COULUMN - I		COULUMN - II
A	$f:R\to\left[\frac{\pi}{4},\pi\right)$ & $f(x)=\cot^{-1}(2x-x^2-2)$, then f(x) is	P	one-one
B	$f:R\to R$ & $f(x)=e^{ax}\sin(bx)$ where $a,b\in R^+$, then f(x) is	Q	into
C	$f:R^+\to[2,\infty)$ & $f(x)=2+3x^2$, then f(x) is	R	many-one
D	$f:X\to X$ & $f(f(x))=x\ \forall x\in X$ then f(x) is	S	onto

3. A function is defined as f:{a_1, a_2, a_3, a_4, a_5, a_6} →{b_1, b_2, b_3}

	COLUMN - I		COLUMN – II
(A)	The number of onto functions	(P)	Is divisible by 9
(B)	Number of function in which $f(a_i) \neq b_i$	(Q)	Is divisible by 5
(C)	Number of invertible functions	(R)	Is divisible by 4
(D)	Number of many one functions	(S)	Is divisible by 3
		(T)	Not possible

THANKS

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ANSWER KEY – RELATION & FUNCTION

SINGLE OPTION CORRECT

1. C	2. A	3. B	4. D
5. B	6. D	7. B	8. A
9. C	10. A	11. B	12. B

PARAGRAPH TYPE

1. B, C, D	2. A, C, D	3. B

MULTI OPTIONS CORRECT

1. A, B & C	2. A, B, C	3. A, B	4. A, C

INTEGER TYPE

1. 4	2. 6	3. 6	4. 2
5. 3	6. 3		

MATRIX MATCH

1. A→R, B→P, R, C→ R, S, D →P, Q, S.
2. A→Q, R, B→R, S, C→P, Q, D → P, S.
3. A → P, Q, R, S, B → P, R, S, C → T, D → P, S

HINTS & SOLUTION

SINGLE OPTION CORRECT

1. C

Solution:

Consider $x^2 - 47x + k = 0$, For real roots $47^2 - 4k \ge 0 \rightarrow k \le 552$

$\therefore$ k = 1, 2, 3, ………, 552

Product of real roots = 1 × 2 × 3 × 4 ×………× 552 = 552!

2. A

Sol: Replace x by –x

$f(-x) + 2f(x) = x^2 + x$

Solving $f(x) = \dfrac{x^2 + 3x}{3}$

$f(f(x)) = \dfrac{(f(x))^2 + 3f(x)}{3} = 0$

$f(x)\,(f(x) + 3) = 0 \rightarrow f(x) = 0$ or $f(x) = -3$

$\Rightarrow x = 0, -3.$ $\qquad x^2 + 3x + 9 = 0$ no solution :

$\therefore$ Sum = – 3

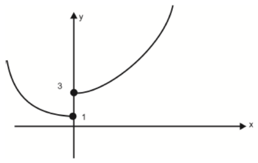
3. B

Sol:

$9^x + (1+1)9^x = 3.9^x \quad x>0$

$f(x)\,9^{-x} + (1-1)9^x = 9^{-x} \quad x < 0$

$2 \qquad x = 0$



4. D

$1 \le [x] - x^2 + 4 \le 2 \rightarrow x^2 - 5 \le [x] \le x^2 - 2$

5. B

Sol: $\log_{x^2} x \ge 0$

Now

Case I

$0 < x^2 < 1$

$\Rightarrow \quad -1 < x < 1$ and $x^2 \ne 1 \quad \Rightarrow \quad x \ne -1, 1$

and $\quad 0 < x < 1$

So $\quad x \in (0, 1)$

Case II

$x^2 > 1$

$\Rightarrow \quad x < -1$, or $x > 1$

and $\quad x^2 \ne 1 \Rightarrow x \ne -1, 1$

and $\quad x > 1$

$\Rightarrow \quad x \in (1, \infty)$

6. D

7. B

$$\frac{5^{200}}{8} = \frac{(1+24)^{100}}{8}$$

$$\therefore \left\{\frac{5^{200}}{8}\right\} = \frac{1}{8}$$

8. A

$g(f(x)) = \tan\left(x-\frac{\pi}{4}\right)=\frac{\tan x-1}{\tan x+1}$

$\Rightarrow g(x)=\frac{x-1}{x+1}$

$f(g(x)) = \tan\left(\frac{x-1}{x+1}\right)$

9. C

$\because f(x)=\tan 2x-\tan x$

$\Rightarrow f(2^n)=\tan 2^{n+1}-\tan 2^n$

$\Rightarrow g(n)=\tan 2^{n+1}-\tan 1$

$g(2013)-\tan 2^{2014}=-\tan 1$

10. A

for x ≥ 2, LHS is always non negative and RHS is always –ve
Hence, for x ≥ 2 no solution
If 1 ≤ x < 2 (x – 2) = (x – 1) – 1 = x – 2 which is an identity
For 0 ≤ x < 1, LHS is '0' and RHS is (–)ve → no solution
x < 0, LHS is (+)ve, RHS is (–)ve → no solution

11. B

Let $a = 2^x$, $b = -3^{x-1}$, $c = -1$
→ $a^3 + b^3 + c^3 = 3abc$

Now, $a^3 + b^3 + c^3 - 3abc = \frac{1}{2}(a+b+c)\sum(a-b)^2$ factorizing and get a + b + c = 0 as a ≠ b ≠ c

Hence, the given equation is; $2^x - 3^{x-1} - 1 = 0$, By trial x = 1 and 2 are solution of this
Now, $2^x = 3^{x-1} + 1$ has no other solution → Number of real solution exactly two.

12. B

If $[x^3 + x^2 + x + 1] = [x^3 + x^2 + 1] + x$, then x is integer
→ $\log_e|[x]| = 2 - |[x]|$ has same solutions as $\log_e|x| = 2 - |x|$, x is integer
→ No. of integral solution = 0

SECTION –III (PARAGRAPH)

1. B, C, D
2. A, C, D
3. B

MULTI OPTION(S) CORRECT

1. A, B & C

Solution:

$$\frac{1}{n+1}+\frac{1}{n+2}+\frac{1}{n+3}+\cdots+\frac{1}{2n}=\left(1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots\ldots+\frac{1}{2n}\right)-\left(1+\frac{1}{2}+\frac{1}{3}+\ldots..+\frac{1}{n}\right)$$

$$\alpha(2n)=1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\cdots\cdots-\frac{1}{2n}=\left(1+\frac{1}{3}+\frac{1}{5}+\ldots.+\frac{1}{2n-1}\right)-\frac{1}{2}\left(1+\frac{1}{2}+\frac{1}{3}+\ldots.+\frac{1}{n}\right)$$

$$\alpha(2n)=1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\cdots\cdots-\frac{1}{2n}=\left(1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots\ldots+\frac{1}{2n}\right)-\left(1+\frac{1}{2}+\frac{1}{3}+\ldots..+\frac{1}{n}\right)$$

$$\alpha(2n)=\frac{1}{n+1}+\frac{1}{n+2}+\frac{1}{n+3}+\cdots\cdots+\frac{1}{2n}$$

Also, $\alpha(2n)<\underbrace{\frac{1}{n}+\frac{1}{n}+\ldots\ldots+\frac{1}{n}}_{n\ \text{times}}=1$ and $\alpha(2n)\geq\underbrace{\frac{1}{2n}+\frac{1}{2n}+\ldots\ldots+\frac{1}{2n}}_{n\ \text{times}}=\frac{1}{2}$

(D) is wrong, as $\alpha(1)=1$

2. A, B, C

Solution:

$f(x) = x^3 + 2x + 1 \rightarrow f'(x) = 3x^2 + 2 > 0\ \forall\ x\in R$, so f(x) is strictly increasing and Bijective function.
So $f^{-1}(x)$ will exist.

(A) $g'(f(x))\, f'(x) = 1$ ……….. (1)
$f(0) = 1$, $f'(0) = 2$ so from (1) we can say, $g'(f(0))\, f'(0) = 1 \to g'(1) \times 2 = 1 \to g'(1) = 1/2$.

(B) $h(g(g(x))) = x \to h'(g(g(x)))\, g'(g(x))\, g'(x) = 1$……….(2)
$g(f(x)) = x \to g(f(f^{-1}(x))) = f^{-1}(x) \to g(x) = f^{-1}(x)$.
$f(0) = 1$, $f(1) = 4 \to f^{-1}(4) = 1 \;\&\; f^{-1}(1) = 0$
$h'(g(g(4)))\, g'(g(4))\, g'(4) = 1 \to h'(0)\, g'(1)\, g'(4) = 1$…………………..(3)
from (1) we get, $g'(f(0))\, f'(0) = 1 \to g'(1) \times 2 = 1 \to g'(1) = 1/2$
$g'(f(1))\, f'(1) = 1 \to g'(4) \times 5 = 1 \to g'(4) = 1/5$
Now, from (3) we get $h'(0) = 10$

(C) $x_0^3 + 2x_0 - 2 = 0 \to f(x_0) = x_0^3 + 2x_0 + 1 = 3 \to g(3) = x_0$
$h(x_0) = h(g(3)) = h(g(g(34))) = 34$

(D) $f^{-1}(x_0) = 2 \to f(2) = x_0 = 13$ so $h(g(g(13))) = 13 \to h(g(2)) = 13$.

3. A, B

Solution:

For b = 1, we have $f(g(0)) = f(\sin(0) + 1) = f(1) = a + 1$

Also, $f\left(g\left(0^+\right)\right) = \lim\limits_{x \to 0^+} f(1 + \sin x) = f(1) = 1 + a$

And $f\left(g\left(0^-\right)\right) = \lim\limits_{x \to 0^-} f(\{x\}) = f(1^-) = 1 + a$

Hence, $f(g(x))$ is continuous for b = 1

For, b < 0, $f(g(x))$ is continuous at x = 0 if 1 = 2 – b for which b = 1, which is not possible

4. A, C

INTEGER OPTION TYPE (0 - 9)

1. 4

Solution:

Number of required bijective functions = $5!\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!}\right) = 44 = 11p(\text{gives}) \to p = 4$

2. 6

3. 6

$\log_2(4\sin^2 x - 2(\sqrt{3}\sin x + \sin x) + (\sqrt{3} + 1)) \geq 0$

$\Rightarrow 4\sin^2 x - 2\sin x(\sqrt{3} + 1) + \sqrt{3} + 1 \geq 1$

$\Rightarrow \sin^2 x - \sin x\left(\frac{\sqrt{3}}{2} + \frac{1}{2}\right) + \frac{\sqrt{3}}{4} \geq 0$

$\Rightarrow \left(\sin x - \frac{\sqrt{3}}{2}\right)\left(\sin x - \frac{1}{2}\right) \geq 0$

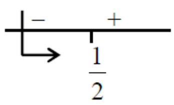
$\Rightarrow -1 \leq \sin x \leq \frac{1}{2}$ or $\frac{\sqrt{3}}{2} \leq \sin x \leq 1$

$\Rightarrow x \in \left[-\pi, \frac{\pi}{6}\right] \cup \left[\frac{\pi}{3}, \frac{2\pi}{3}\right] \cup \left[\frac{5\pi}{6}, \pi\right]$

Number of integral solutions 4 + 1 + 1 = 6

4. 2

$\Rightarrow f'(x) = \ell n 2x + 1 - 1 = \ell n 2x$



$\Rightarrow f\left(\frac{1}{2}\right) = -\frac{1}{2}$, $f\left(\frac{e}{2}\right) = \frac{e}{2}\ell ne - \frac{e}{2} = 0$

$\Rightarrow$ Range $\left[-\frac{1}{2}, 0\right] \Rightarrow a + b = 2$

5. 3

$-x^2+10x-16\ge 0 \Rightarrow 2\le x\le 8$
$-x^2+10x-16 < x^2-4x+4$
$\Rightarrow 2x^2-14x+20>0 \Rightarrow x>5\, or\, x<2$
$\Rightarrow x=6,7,8$

6. 3

Replacing x by $\frac{1}{(1-x)}$, we obtain $f\left(\frac{1}{1-x}\right)+f\left(1-\frac{1}{x}\right)=-2x+\frac{2}{x}$

Again, replacing x by $1-\frac{1}{x}$

7. 8

$\left[\frac{x}{9}\right]=\left[\frac{x}{11}\right]=I$

$\Rightarrow I\le\frac{x}{9}<I+1, I\le\frac{x}{11}<I+1,$ Solution is possible only when $11I<9I+9$

$\Rightarrow 0\le I<\frac{9}{2}$

Total number of solution $\sum_{I=0}^{4}(9-2I)-1=24$

8. 0
9. 0

Let $\tan^{-1}x=\theta \Rightarrow \theta\in\left(-\frac{\pi}{4},0\right)$

$f(x)=\frac{1+\tan\theta+|\sec\theta|}{1-\tan\theta+|\sec\theta|}=\frac{\sec\theta+\tan\theta+1}{\sec\theta-1\tan\theta+1}$

$=\sec\theta+\tan\theta$

$=\frac{1+\sec\theta}{\cos\theta}=\frac{1+\cos\left(\frac{\pi}{2}-\theta\right)}{\sin\left(\frac{\pi}{2}-\theta\right)}$

$=\frac{2\cos^2\left(\frac{\pi}{4}-\frac{\theta}{2}\right)}{2\sin\left(\frac{\pi}{4}-\frac{\theta}{2}\right).\cos\left(\frac{\pi}{4}-\frac{\theta}{2}\right)}=\cot\left(\frac{\pi}{4}-\frac{\theta}{2}\right)$

if $\theta\in\left(-\frac{\pi}{4},0\right) \Rightarrow \frac{\pi}{4}<\frac{\pi}{4}-\frac{\theta}{2}<\frac{3\pi}{8}$

$\therefore \cot^{-1}f(x)=4$

$\Rightarrow \cot^{-1}\cot\left(\frac{\pi}{4}-\frac{\theta}{2}\right)=4$

$\frac{\pi}{4}-\frac{\tan^{-1}x}{2}=4$

$\Rightarrow \frac{\pi-16}{2}=\tan^{-1}x\notin(-1,0)$

10. 1

We have $a=\frac{x(x^6+1)}{x^2+1}$

$\Rightarrow x^6+1=a\left(\frac{x^2+1}{x}\right)\ge 2a$

$\Rightarrow 2a-x^6\le 1$

11. 5
12. 3

MATRIX MATCH TYPE

1. A→R, B→P, R C→ R, S D →P, Q, S.
2. A→Q, R B→R, S C→P, Q D → P, S.
3. (A) → p, q, r, s (B) → p, r, s (C) → t (D) → p, s