



MATHS

BOOKS - VIKAS GUPTA MATHS (HINGLISH)

FUNCTION

Single Choice Problems

1. Range of the function $f(x) = \log_{\sqrt{2}}(2 - \log_2 16 \sin^2 x + 1)$ is:

- A. $[0, 1]$
- B. $(-\infty, 2]$
- C. $[-1, 1]$
- D. $(-\infty, \infty)$

Answer: B



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2. The values of α and β for which $|e^{|x-\beta|} - \alpha| = 2$ has four distinct solutions are

A. $a \in (-2, \infty), b = 0$

B. $a \in (2, \infty), b = 0$

C. $a \in (3, \infty), b \in R$

D. $a \in (2, \infty)b = 0$

Answer: C



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3. The range of the function : $f(x) = \tan^{-1} x + \frac{1}{2}\sin^{-1} x$

A. $(-\pi/2, \pi/2)$

B. $[-\pi/2, \pi/2] - \{0\}$

C. $[-\pi/2, \pi/2]$

D. $(-3\pi/4, 3\pi/4)$

Answer: C



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4. Find the number of real ordered pair(s) (x, y) for which:

$$16^{x^2+y} + 16^{x+y^2} = 1$$

A. 0

B. 1

C. 2

D. 3

Answer: B



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5. The range of values of 'a' such that $\left(\frac{1}{2}\right)^{|x|} = x^2 - a$ is satisfied for maximum number of values of 'x'

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

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

C. $(-1, 1)$

D. $(-1, \infty)$

Answer: D



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6. For a real number x , let $[x]$ denote the greatest integer less than or equal to x . Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 2x + [x] + \sin x \cos x$, then 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: A



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7. The maximum value of $\sec^{-1}\left(\frac{7 - 5(x^2 + 3)}{2(x^2 + 2)}\right)$ is:

A. $\frac{5\pi}{6}$

B. $\frac{5\pi}{12}$

C. $\frac{7\pi}{12}$

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

Answer: D



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8. Number of ordered pair (a,b) the set $A = \{1, 2, 3, 4, 5\}$ so that the function $f(x) = \frac{x^3}{3} + \frac{a}{2}x^2 + bx + 10$ is an injective mapping $\forall x \in R$:

A. 13

B. 14

C. 15

D. 16

Answer: C



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9. Let A be the greatest value of the function $f(x) = \log_x[x]$, (where $[\cdot]$ denotes greatest integer function) and B be the least value of the function $g(x) = |\sin x| + |\cos x|$, then :

A. $A > B$

B. $A < B$

C. $A = B$

D. $2A + B = 4$

Answer: C



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10. The function $f: (a, \infty) \rightarrow R$ where R denotes the range corresponding to the given domain, with rule $f(x) = 2x - 3x^2 + 6$, will have an inverse provided

A. $a = 1, B = [5, \infty)$

B. $a = 2, B = [10, \infty)$

C. $a, 0, B = [6, \infty)$

D. $a = -1, B = [1, \infty)$

Answer: A



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11. Solution of the inequation $\{x\}(\{x\} - 1)(\{x\} + 2) \geq 0$

where $\{.\}$ denotes fractin part function) is :

A. $x \in (-2, 1)$

B. $x \in I$ (I denote set of integers)

C. $x \in [0, 1)$

D. $x \in [-2, 0)$

Answer: B



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12. Let $f(x), g(x)$ be two real valued functions then the function

$h(x) = 2 \max \{f(x) - g(x), 0\}$ is equal to :

A. $f(x) - g(x) - |g(x) - f(x)|$

B. $f(x) + g(x) - |g(x) - f(x)|$

C. $f(x) - g(x) + |g(x) - f(x)|$

D. $f(x) + g(x) + |g(x) - f(x)|$

Answer: C



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13. Let $R = \{(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)\}$ be a relation the set $A = \{1, 2, 3, 4\}$. The relation R is

A. a function

B. reflexive

C. not symmetric

D. transitive

Answer: C



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14. The true set of valued of 'K' for which $\sin^{-1}\left(\frac{1}{1 + \sin^2 x}\right) = \frac{k\pi}{6}$ may

have a solution is :

A. $\left[\frac{1}{4}, \frac{1}{2}\right]$

B. $[1, 2]$

C. $\left[\frac{1}{6}, \frac{1}{2}\right]$

D. $[2, 4]$

Answer: B



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

A. $-f(x)$

B. $f(x)$

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

D. $f(-x)$

Answer: A



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16. Let $g: R \rightarrow R$ be given by $g(x) = 3 + 4x$ if $g^n(x) = \text{gogogo.....og}(x)$ n times. Then inverse of $g^n(x)$ is equal to :

A. $(x + 1 - 4^n) \cdot 4^{-n}$

B. $(x - 1 + 4^n)4^{-n}$

C. $(x + 1 + 4^n)4^{-n}$

D. None of these

Answer: A



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17. Let $f: D \rightarrow R$ be defined as $f(x) = \frac{x^2 + 2x + a}{x^2 + 4x + 3a}$ where D and R denote the domain of f and the set of all the real numbers respectively. If f is surjective mapping. Then the complete range of a is :

A. $0 < a \leq 1$

B. $0 < a \leq 1$

C. $0 \leq a < 1$

D. $0 < a < 1$

Answer: D



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18. Let $f: (-\infty, 2] \rightarrow (-\infty, 4]$ be a function defined by $f(x) = 4x - x^2$. Then, $f^{-1}(x)$ is

A. $2 - \sqrt{4 - x}$

B. $2 + \sqrt{4 - x}$

C. $-2 + \sqrt{4 - x}$

D. $-2 - \sqrt{4 - x}$

Answer: A

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19. IF $[5 \sin x] + [\cos x] + 6 = 0$, then range of $f(x) = \sqrt{3} \cos x + \sin x$ corresponding to solution set of the given equation is: (where $[.]$ denotes greatest integer function)

A. $[-2, -1]$

B. $\left(-\frac{3\sqrt{3} + 2}{5}, -1\right)$

C. $[-2, -\sqrt{3})$

D. $\left(-\frac{3\sqrt{3} + 4}{5}, -1\right)$

Answer: D

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20. If $f: R \rightarrow R$ where $f(x) = ax + \cos x$ is an invertible function, then

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

B. $[-1, 1]$

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

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

Answer: C



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21. The range of

$$f(x) = [1 + \sin x] + \left[2 + s \in \frac{2}{x}\right] + \left[3 + s \in \frac{x}{3}\right] + \left[n + s \in \frac{x}{n}\right] \forall x$$

, where $[.]$ denotes the greatest integer function, is,

$$\left\{ \frac{n+n-2^2}{2}, \frac{n(n+1)}{2} \right\} \quad \left\{ \frac{n(n+1)}{2} \right\}$$

$$\left\{ \frac{n^2+n-2^{\square}}{2}, \frac{n(n+1)}{2}, \frac{n^2+n+2}{2} \right\} \quad \left[\frac{n(n+1)}{2}, \frac{n^2+n+2}{2} \right]$$

A. $\left\{ \frac{n^2 + n - 2}{2}, \frac{n(n + 1)}{2} \right\}$

B. $\left\{ \frac{n(n + 1)}{2} \right\}$

C. $\left\{ \frac{n(n + 1)}{2}, \frac{n^2 + n + 2}{2}, \frac{n^2 + n + 4}{2} \right\}$

D. $\left\{ \frac{n(n + 1)}{2}, \frac{n^2 + n - 2}{2} \right\}$

Answer: D



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22. $f: R \rightarrow R$, where $f(x) = \frac{x^2 + ax + 1}{x^2 + x + 1}$ Complete set of values of 'a'

such that $f(x)$ is onto, is

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

B. $(-\infty, 0)$

C. $(0, \infty)$

D. not possible

Answer: D



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23. If $f(x)$ and $g(x)$ are two function such that $f(x) = [x] + [-x]$ and $g(x) = \{x\} \forall x \in R$ and $h(x) = f(g(x))$, then which of the following is incorrect ? $[.]$ denotes greatest integer function and $\{.\}$ denotes fractional part function)

- A. $f(x)$ and $h(x)$ are identical functions
- B. $f(x) = g(x)$ has no solution
- C. $f(x) + h(x) > 0$ has no solution
- D. $f(x) - h(x)$ is a periodic function

Answer: B



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24. Find the number of values of $f(x) = \left[\frac{x}{15} \right] \left[-\frac{15}{x} \right]$ can take where $x \in (0, 90)$ whete $[.] = \text{GIF}$

A. 5

B. 6

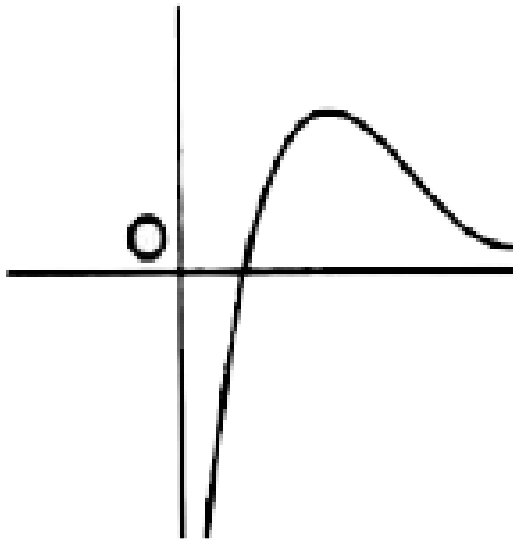
C. 7

D. Infinite

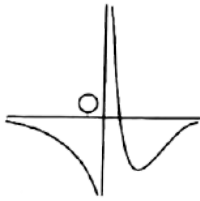
Answer: B

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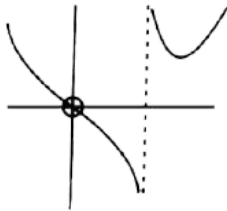
25. The graph of function $f(x)$ is shown below :



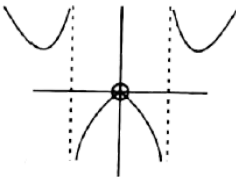
Then the graph of $g(x) = \frac{1}{f(|x|)}$ is:



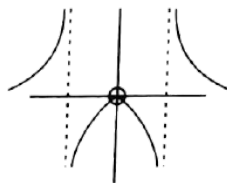
A.



B.



C.



D.

Answer: C

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26. Which of the following function is homogeneous ?

A. $f(x) = x \sin y + y \sin x$

B. $g(x) = xz \frac{y}{x} + ye \frac{x}{y}$

C. $h(x) = \frac{xy}{x + y^2}$

D. $\phi(x) = \frac{x - y \cos x}{y \sin x + y}$

Answer: B



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27. Let $f(x) = \begin{cases} 2x + 3 & x > 1 \\ \alpha^2 x + 1 & x \leq 1 \end{cases}$ If range of $f(x) = R$ (set of real

numbers) then number of integral value(s), which α any take :

A. 2

B. 3

C. 4

D. 5

Answer: C

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28. The maximum integral values of x in the domain of

$$f(x) = \log_{10} \left(\log_{1/3} (\log_4 (x - 5)) \right) \text{ is :}$$

A. 5

B. 7

C. 8

D. 9

Answer: C

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29. Range of the function $f(x) = \log_2 \left(\frac{4}{\sqrt{x+2} + \sqrt{2-x}} \right)$ is

A. $(0, \infty)$

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

C. $[1, 2]$

D. $\left[\frac{1}{4}, 1\right]$

Answer: B



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30. Number of integers stastifying the equation

$$|x^2 + 5x| + |x - x^2| = |6x| \text{ is:}$$

A. 3

B. 5

C. 7

D. 9

Answer: C



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31. Which of the following is not an odd function ?

A. $\ln \left(\frac{x^4 + x^2 + 1}{(x^2 + x + 1)^2} \right)$

B. $\text{sgn}(\text{sgn}(x))$

C. $\sin(\tan x)$

D. $f(x)$,

where

$$f(x) + f\left(\frac{1}{x}\right) = f(x)f\left(\frac{1}{x}\right) \forall x \in \mathbb{R} - \{0\} \text{ and } f(2) = 33$$

Answer: D



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32. Which of the following function is periodic with fundamental period π

?

A. $f(x) = \cos x \left\lfloor \frac{\sin x}{2} \right\rfloor$, where $\lfloor \cdot \rfloor$ denotes greatest integer function

B. $g(x) = \frac{\sin x + \sin 7x}{\cos x + \cos 7x} + |\sin x|$

C. $h(x) = \{x\} + |\cos x|$, where $\{.\}$ denotes fractional part function

D. $\phi(x) = |\cos x| + \ln(\sin x)$

Answer: B

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33. Let $f: N \rightarrow Z$ and $f(x) = \begin{cases} \frac{x-1}{2} & \text{when } x \text{ is odd} \\ -\frac{x}{2} & \text{when } x \text{ is even} \end{cases}$, then:

- A. $f(x)$ is bijective
- B. $f(x)$ is injective but not surjective
- C. $f(x)$ is not injective but surjective
- D. $f(x)$ is neither injective nor surjective

Answer: A

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34. Let $g(x)$ be the inverse of $f(x) = \frac{2^{x+1} - 2^{1-x}}{2^x + 2^{-x}}$ then $g(x)$ be :

A. $\frac{1}{2} \log_2 \left(\frac{2+x}{2-x} \right)$

B. $-\frac{1}{2} \log_2 \left(\frac{2+x}{2-x} \right)$

C. $\log_2 \left(\frac{2+x}{2-x} \right)$

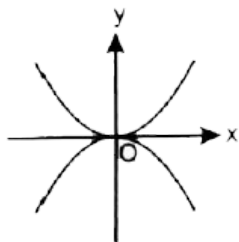
D. $\log_2 \left(\frac{2-x}{2+x} \right)$

Answer: C

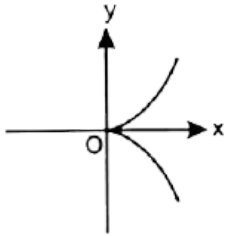


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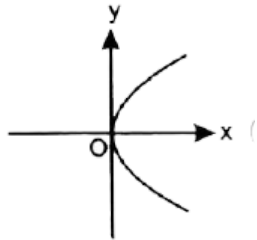
35. Which of the following is the graph of the curve $\sqrt{|y|} = x$ is ?



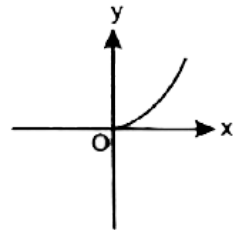
A.



B.



C.



D.

Answer: B



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36. Range of $f(x) = \log_{(x)}(9 - x^2)$, where $[\cdot]$ denotes G.I.E.' is :

A. $\{1, 2\}$

B. $(-\infty, 2)$

C. $(-\infty, \log_2 5]$

D. $[\log_2 5, 3]$

Answer: C



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37. if $e^x + e^{f(x)} = e$ then for $f(x)$

A. Domain is $(-\infty, 1)$

B. Range is $(-\infty, 1]$

C. Domain is $(-\infty, 0]$

D. Range is $(-\infty, 0]$

Answer: A



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38. A lion moves in the region given by the graph $y - |y| - x + |x| = 0$.

curve a person can move so that he does not encounter lion -

A. $y = x^2$

B. $y = \operatorname{sgn}(-e^2)$

C. $y = \log_{1/3} x$

D. $y = m + |x|, m > 3$

Answer: D



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39. If $|f(x) + 6 - x^2| = |f(x)| + |4 - x^2| + 2$, then $f(x)$ is necessarily non-negative for

A. $x \in [-2, 2]$

B. $x \in (-\infty, -2) \cup (2, \infty)$

C. $x \in [-\sqrt{6}, \sqrt{6}]$

D. $x \in [-5, -2] \cup [2, 5]$

Answer: A



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40. Let $f(x) = \cos(px) + \sin x$ be periodic, then p must be :

- A. Positive real number
- B. Negative real number
- C. Rational
- D. Prime

Answer: C



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41. The domain of $f(x)$ is $(0, 1)$. Then the domain of $(f(e^x) + f(\ln|x|))$ is
(a) $(-1, e)$ (b) $(1, e)$ (c) $(-e, -1)$ (d) $(-e, 1)$

A. $\left(\frac{1}{e}, 1\right)$

B. $(-e, 1)$

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

D. $(-e, -1) \cup (1, e)$

Answer: B



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42. Let $A = \{1, 2, 3, 4\}$ and $f: A \rightarrow A$ satisfy
 $f(1) = 2, f(2) = 3, f(3) = 4, f(4) = 1$. Suppose $g: A \rightarrow A$ satisfies
 $g(1) = 3$ and $f \circ g = g \circ f$, then $g =$

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

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

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

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

Answer: B



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43. Number of solutions of the equation, $[y + [y]] = 2 \cos x$ is: (where $y = 1/3)[\sin x + [\sin x + [\sin x]]]$ and $[\] =$ greatest integer function) 0

(b) 1 (c) 2 (d) ∞

A. 0

B. 1

C. 2

D. Infinite

Answer: A



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44. The function $f(x) = \left\{ \frac{(x^{2n})}{(x^{2n} \operatorname{sgn} x)^{2n+1}} \left(\frac{e^{\frac{1}{x}} - e^{-\frac{1}{x}}}{e^{\frac{1}{x}} + e^{-\frac{1}{x}}} \right) \right\} x \neq 0, n \in \mathbb{N}$

is:

- A. Odd function
- B. Even function
- C. Neither odd nor even function
- D. Constant function

Answer: B



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45. $f(1) = 1$ and $f(n) = 2 \sum_{r=1}^{n-1} f(r)$. Then $\sum_{n=1}^m f(n)$ is equal to (A) $3^m - 1$ (B) 3^m (C) 3^{m-1} (D) none of these

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

B. 3^m

C. 3^{m-1}

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

Answer: C

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46. Let $f(x) = \frac{x}{\sqrt{1+x^2}}$ then n times (fo fo foof)(x) is :

A. $\frac{x}{\sqrt{1 + (\sum_{r=1}^n r) x^2}}$

B. $\frac{x}{\sqrt{1 + (\sum_{r=1}^n 1) x^2}}$

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

D. $\frac{n\pi}{\sqrt{1+\pi x^2}}$

Answer: B

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47. Let $f: \mathbb{R} \rightarrow \mathbb{R}$, then $f(x) = 2x + |\cos x|$ is

- A. One-one into
- B. One-one and onto
- C. Many-one and into
- D. Many-one and onto

Answer: B



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48. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = x^3 + x^2 + 3x + \sin x$.

Then f is

- A. One-one end into
- B. One-one and onto
- C. Many-one and into
- D. many-one and onto

Answer: B



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49. If $f(x) = \{x\} + \{x + 1\} + \{x + 2\} \dots \dots \dots \{x + 99\}$, then the value of $[f(\sqrt{2})]$ is, where $\{.\}$ denotes fractional part function & $[.]$ denotes the greatest integer function

A. 5050

B. 4950

C. 41

D. 14

Answer: C



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50. If $|\cot x + \operatorname{cosec} x| = |\cot x| + \operatorname{cosec} x$, $x \in [0, 2\pi]$, then complete set of values of x is :

A. $[0, \pi]$

B. $\left(0, \frac{\pi}{2}\right]$

C. $\left(0, \frac{\pi}{2}\right] \cup \left[\frac{3\pi}{2}, 2\pi\right)$

D. $\left(\pi, \frac{3\pi}{2}\right] \cup \left[\frac{7\pi}{4}, 2\pi\right]$

Answer: C



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51. The function $f(x) = 0$ has eight distinct real solutions and f also satisfies $f(4+x) = f(4-x)$. The sum of all the eight solutions of $f(x) = 0$ is :

A. 12

B. 32

C. 16

D. 15

Answer: B



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52. Let $f(x)$ polynomial of degree 5 with leading coefficient unity such that $f(1)=5, f(2)=4, f(3)=3, f(4)=2, f(5)=1$, then $f(6)$ is equal to

A. 0

B. 24

C. 120

D. 720

Answer: C



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53. Let $f: A \rightarrow B$ be a function such that $f(x) = \sqrt{x-2} + \sqrt{4-x}$, is invertible, then which of the following is not possible ?

A. $A = [3, 4]$

B. $A = [2, 3]$

C. $A = [2, 2\sqrt{3}]$

D. $\{2, 2\sqrt{2}\}$

Answer: C



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54. Find the number of positive integral values of x satisfying

$$\left[\frac{x}{9} \right] = \left[\frac{x}{11} \right] \text{ is where } [.] = \text{G.I.F.}$$

A. 21

B. 22

C. 23

Answer: D**Watch Video Solution**

55. The domain of function $f(x) = \log_{\left[x + \frac{1}{2}\right]} (2x^2 + x - 1)$, where $[.]$ denotes the greatest integer function is :

A. $\left[\frac{3}{2}, \infty\right)$

B. $(2, \infty)$

C. $\left(-\frac{1}{2}, \infty\right) - \left\{\frac{1}{2}\right\}$

D. $\left(\frac{1}{2}, 1\right) \cup (1, \infty)$

Answer: A**Watch Video Solution**

56. The solution set of the equation $[x]^2 + [x + 1] - 3 = 0$, where $[.]$ represents greatest integral function is :

- A. $[-1, 0) \cup [1, 2)$
- B. $[-2, -1) \cup [1, 2]$
- C. $[1, 2]$
- D. $[-3, -2) \cup [2, 3)$

Answer: B



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57. Which among the following relations is a function ?

A. $x^2 + y^2 = r^2$

B. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = r^2$

C. $y^2 = 4ax$

D. $x^2 = dxy$

Answer: D



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58. A function $f: R \rightarrow R$ is defined as $f(x) = 3x^2 + 1$. then $f^{-1}(x)$ is :

A. $\frac{\sqrt{x-1}}{3}$

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

C. f^{-1} does not exist

D. $\sqrt{\frac{x-1}{3}}$

Answer: C



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59. If $f(x) = \begin{cases} 2 + x, & x \geq 0 \\ 4 - x, & x < 0 \end{cases}$, then $f(f(x))$ is given by :

A. $f(f(x)) = \begin{cases} 4 + x, & x \geq 0 \\ 6 - x, & x < 0 \end{cases}$

$$B. f(f(x)) = \begin{cases} 4 + x, & x \geq 0 \\ x, & x < 0 \end{cases}$$

$$C. f(f(x)) = \begin{cases} 4 - x, & x \geq 0 \\ x, & x < 0 \end{cases}$$

$$D. f(f(x)) = \begin{cases} 4 - x, & x \geq 0 \\ x + 2x, & x < 0 \end{cases}$$

Answer: A



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60. The function $f: R \rightarrow R$ defined as $f(x) = \frac{3x^2 + 3x - 4}{3 + 3x - 4x^2}$ 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: B



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61. The number of solutions of the equation $e^x - \log|x| = 0$ is :

A. 0

B. 1

C. 2

D. 5

Answer: B



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62. If complete solution set of $e^{-x} \leq 4 - x$ is $[\alpha, \beta]$ then $[\alpha] + [\beta]$ is equal to : (where $[.]$ denotes greatest integer function)

A. 0

B. 2

C. 1

D. 4

Answer: C



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63. Range of $f(x) = \sqrt{\sin(\log_7(\cos(\sin x)))}$ is:

A. $[0, 1]$

B. $\{0, 1\}$

C. $\{0\}$

D. $[1, 7]$

Answer: C



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64. If the domain of $y = f(x)$ is $[-3, 2]$, then find the domain of $g(x) = f(|[x]|)$, where $[]$ denotes the greatest integer function.

A. $[-3, 2]$

B. $[-2, 3]$

C. $[-3, 3]$

D. $[-2, 3]$

Answer: B

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65. Range of the function

$f(x) = \cot^{-1}\{-x\} + \sin^{-1}\{x\} + \cos^{-1}\{x\}$, where $\{.\}$ denotes

fractional part function:

A. $\left(\frac{3\pi}{4}, \pi\right)$

B. $\left[\frac{3\pi}{4}, \pi\right)$

C. $\left[\frac{3\pi}{4}, \pi\right]$

D. $\left(\frac{3\pi}{4}, \pi\right]$

Answer: D

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66.

Let

$$f: R - \left\{ \frac{3}{2} \right\} \rightarrow R, f(x) = \frac{3x + 5}{2x - 3}. \text{ Let } f_1(x) = f(x), f_n(x) = f(f_{n-1}(x))$$

for $\pi \geq 2, n \in N$, then $f_{2008}(x) + f_{2009}(x) =$

A. $\frac{2x^2 + 5}{2x - 3}$

B. $\frac{x^2 + 5}{2x - 3}$

C. $\frac{2x^2 - 5}{2x - 3}$

D. $\frac{x^2 - 5}{2x - 3}$

Answer: A

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67. Find the range of the function $f(x) = \frac{(1 + x + x^2)(1 + x^4)}{x^3}$

A. $[0, \infty]$

B. $[2, \infty]$

C. $[4, \infty]$

D. $[6, \infty]$

Answer: D



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68. The function $f: (-\infty, 3] \rightarrow (0, e^7]$ defined by $f(x) = e^{x^3 - 3x^2 - 9x + 2}$

is

A. Many one and onto

B. Many one and into

C. One to one and onto

D. One to one and into

Answer: A

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69. If $f(x) = \sin(\log)_e \left\{ \frac{\sqrt{4-x^2}}{1-x} \right\}$, then the domain of $f(x)$ is _____ and its range is _____.

- A. $[-1, 1]$
- B. $[0, 1]$
- C. $[-1, 1)$
- D. None of these

Answer: A

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70. Set of values of 'a' for which the function $f: R \rightarrow R$, given by $f(x) = x^3 + (a+2)x^2 + 3ax + 10$ is one-one is given by:

- A. $(-\infty, 1] \cup [4, \infty)$

B. $[1, 4]$

C. $[1, \infty]$

D. $[-\infty, 4]$

Answer: B



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71. If the range of the function $F(x) = \tan^{-1}(3x^2 + bx + c)$ is $\left[0, \frac{\pi}{2}\right)$;
(domain in R) then :

A. $b^2 = 3c$

B. $b^2 = 4c$

C. $b^2 = 12c$

D. $b^2 = 8c$

Answer: C



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72. Let $f(x) = \sin^{-1} x - \cos^{-1} x$, x , then the set of values of k for which of $|f(x)| = k$ has exactly two distinct solutions is :

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

B. $\left(0, \frac{\pi}{2}\right]$

C. $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right)$

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

Answer: A



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73. Let $f: R \rightarrow R$ is defined by

$$f(x) = \begin{cases} (x+1)^3 & x \leq 1 \\ \ln x + (b^2 - 3b + 10) & x > 1 \end{cases} \text{ If } f(x) \text{ is invertible, then the}$$

set of all values of 'b' is :

A. $\{1, 2\}$

B. ϕ

C. $\{2, 5\}$

D. None of these

Answer: A



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74. If $f(x)$ is continuous such that $|f(x)| \leq 1, \forall x \in R$ and $g(x) = \frac{e^{f(x)} - e^{-|f(x)|}}{e^{f(x)} + e^{-|f(x)|}}$, then range of $g(x)$ is

A. $[0, 1]$

B. $\left[0, \frac{e^2 + 1}{e^2 - 1}\right]$

C. $\left[0, \frac{e^2 - 1}{e^2 + 1}\right]$

D. $\left[\frac{e^2 + 1}{e^2 + 1}, 0\right]$

Answer: D

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75. Consider all function $f: \{1, 2, 3, 4\} \rightarrow \{1, 2, 3, 4\}$ which are one-one, onto and satisfy the following property :

If $f(k)$ is odd then $f(k + 1)$ is even, $k = 1, 2, 3$. The number of such function is :

A. 4

B. 8

C. 12

D. 16

Answer: C

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76. Consider the function $f: R - \{1\} \rightarrow R - \{2\}$ given by

$$f\{x\} = \frac{2x}{x - 1}. \text{ Then}$$

- A. f is one-one but not onto
- B. f is onto but not one-one
- C. f is neither one-one nor onto
- D. f is one-one and onto

Answer: D

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77. If range of function $f(x)$ whose domain is set of all real numbers is $[-2, 4]$, then range of function $g(x) = \frac{1}{2}f(2x + 1)$ is equal to :

- A. $[-2, 4]$
- B. $[-1, 2]$
- C. $[-3, 9]$
- D. $[-2, 2]$

Answer: B



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78. Let $f: R \rightarrow R$ and $f(x) = \frac{x(x^4 + 1)(x + 1) + x^4 + 2}{x^2 + x + 1}$, then $f(x)$ is

:

- A. one-one, not
- B. Many-one onto
- C. One-one, onto
- D. Many one, into

Answer: D



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79. Let $f(x)$ be defined as

$$f(x) = \begin{cases} |x| & 0 \leq x < 1 \\ |x - 1| + |x - 2| & 1 \leq x < 2 \\ |x - 3| & 2 \leq x < 3 \end{cases}$$

The range of function $g(x) = \sin(7(f(x)))$ is :

A. $[0, 1]$

B. $[-1, 0]$

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

D. $[-1, 1]$

Answer: D



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80. If $[x]^2 - 7[x] + 10 < 0$ and $4[y]^2 - 16[y] + 7 < 0$, then $[x + y]$ cannot be ($[.]$ denotes greatest integer function):

A. 7

B. 8

C. 9

D. both (b) and (c)

Answer: C

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

- A. $f(x)$ is many one, onto function
- B. $f(x)$ is many one, into function
- C. $f(x)$ is decreasing function $\forall n \in R$
- D. $f(x)$ is bijective function

Answer: B

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82. The function $f(x)$ satisfy the equation

$$f(1-x) + 2f(x) = 3x \quad \forall x \in R, \text{ then } f(0) =$$

- A. -2
- B. -1

C. 0

D. 1

Answer: B



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83. Let $f: [0, 5] \rightarrow [0, 5)$ be an invertible function defined by $f(x) = ax^2 + bx + C$, where $a, b, c \in \mathbb{R}$, $abc \neq 0$, then one of the root of the equation $cx^2 + bx + a = 0$ is:

A. a

B. b

C. c

D. $a + b + c$

Answer: A



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84. Let $f(x) = x^2 + \lambda x + \mu \cos x$, λ being an integer and μ is a real number. The number of ordered pairs (λ, μ) for which the equation $f(x) = 0$ and $f(f(x)) = 0$ have the same (non empty) set of real roots is:

A. 2

B. 3

C. 1

D. 6

Answer: C



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85. Consider all function $f: \{1, 2, 3, 4\} \rightarrow \{1, 2, 3, 4\}$ which are one-one, onto and satisfy the following property :

If $f(k)$ is odd then $f(k + 1)$ is even, $K = 1, 2, 3$. The number of such function is :

A. 4

B. 8

C. 12

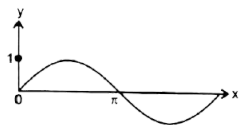
D. 16

Answer: C

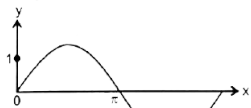


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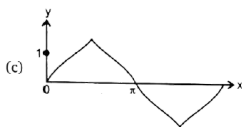
86. Which of the following is closest to the graph of $y = \tan(\sin x)$, $x > 0$?



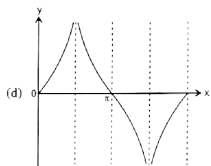
A.



B.



C.



D.

Answer: B

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87. Consider the function $f: \mathbb{R} - \{1\} \rightarrow \mathbb{R} - \{2\}$ given by

$$f(x) = \frac{2x}{x-1}. \text{ Then}$$

A. f is one-one but not onto

B. f is onto but not one-one

C. f is one-one nor onto

D. f is both one-one and onto

Answer: D



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88. If range of function $f(x)$ whose domain is set of all real numbers is $[-2, 4]$, then range of function $g(x) = \frac{1}{2}f(2x + 1)$ is equal to :

A. $[-2, 4]$

B. $[-1, 2]$

C. $[-3, 9]$

D. $[-2, 2]$

Answer: B



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89. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ and $f(x) = \frac{x(x^4 + 1)(x + 1) + x^4 + 2}{x^2 + x + 1}$, then $f(x)$ is

:

- A. One-one, into
- B. Many one, onto
- C. One-one, onto
- D. Many one, into

Answer: D



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90. Let $f(x)$ be defined as

$$f(x) = \begin{cases} |x| & 0 \leq x < 1 \\ |x - 1| + |x - 2| & 1 \leq x < 2 \\ |x - 3| & 2 \leq x < 3 \end{cases}$$

The range of function $g(x) = \sin(7(f(x)))$ is :

- A. $[0, 1]$

B. $[-1, 0]$

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

D. $[-1, 1]$

Answer: D



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91. Number of integral values of x in the domain of function

$$f(x) = \sqrt{\ln(|\ln x|)} + \sqrt{7|x| - (|x|)^2 - 10}$$
 is equal to

A. 5

B. 6

C. 7

D. 8

Answer: B



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92. The complete set of values of x in the domain of function

$$f(x) = \sqrt{\log_{x+2}\{x\} \left([x]^2 - 5[x] + 7 \right)}$$

where $[.]$ denote greatest integer function and $\{.\}$ denote fraction part function) is :

A. $\left(-\frac{1}{3}, 0\right) \cup \left(\frac{1}{3}, 1\right) \cup (2, \infty)$

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

C. $\left(-\frac{2}{3}, 0\right) \cup \left(\frac{1}{3}, 1\right) \cup (1, \infty)$

D. $\left(-\frac{1}{3}, 0\right) \cup \left(\frac{1}{3}, 1\right) \cup (1, \infty)$

Answer: D



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93. The number of integral ordered pair (x,y) that satisfy the system of

equatin $|x + y - 4| = 5$ and $|x - 3| + |y - 1| = 5$ is/are:

A. 2

B. 4

C. 6

D. 12

Answer: D



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94. $f: R \rightarrow R$, where $f(x) = \frac{x^2 + ax + 1}{x^2 + x + 1}$ Complete set of values of 'a'

such that $f(x)$ is onto, is

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

B. $(-\infty, 0)$

C. $(0, \infty)$

D. Empty set

Answer: D



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95. If $A = \{1, 2, 3, 4\}$ and $f : A \rightarrow A$, then total number of invertible functions, 'f', such that $f(2) \neq 2, f(4) \neq 4, f(1) = 1$ is equal to:

A. 1

B. 2

C. 3

D. 4

Answer: C



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96. The domain of definition of $f(x) = \log_{(x^2 - x + 1)}(2x^2 - 7x + 9)$ is :

A. \mathbb{R}

B. $\mathbb{R} - \{0\}$

C. $\mathbb{R} - \{0, 1\}$

D. $R - \{1\}$

Answer: C



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97. If $A = \{1, 2, 3, 4\}$ $B = \{1, 2, 3, 4, 5, 6\}$ and $f: A \rightarrow B$ is an injective mapping satisfying $f(i) \neq i$, then number of such mappings are :

A. 182

B. 181

C. 183

D. None of these

Answer: B



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98. Let $f(x) = x^2 - 2x - 3, x \geq 1$ and $g(x) = 1 + \sqrt{x + 4}, x \geq -4$ then the number of real solution os equation $f(x) = g(x)$ is/are

- A. 0
- B. 1
- C. 2
- D. 4

Answer: B



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One Or More Than One Answ Is Are Correct

1. $f(x)$ is an even periodic function with period 10 In

$$[0, 5], f(x) = \begin{cases} 2x & 0 \leq x < 2 \\ 3x^2 - 8 & 2 \leq x < 4 \\ 10x & 4 \leq x \leq 5 \end{cases} . \text{ Then:}$$

A. $f(-4) = 40$

B. $\frac{f(-13) - f(11)}{f(13) + f(-11)} = \frac{17}{21}$

C. $f(5)$ is not defined

D. Range of $f(x)$ is $[0, 50]$

Answer: A::B::D

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2. Let $f(x) = \left| |x^2 - 4x + 3| - 2 \right|$. Which of the following is/are correct ?

A. $f(x) = m$ has exactly two real solutions of different sign $\forall m > 2$

B. $f(x) = m$ has exactly two real solutions $\forall m \in (2, \infty) \cup \{0\}$

C. $f(x) = m$ has no solutions $\forall m < 0$

D. $f(x) = m$ has four distinct real solutions $\forall m \in (0, 1)$

Answer: A::B::C::D

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3. Let $f(x) = \cos^{-1}\left(\frac{1 - \tan^2(x/2)}{1 + \tan^2(x/2)}\right)$ Which of the following statement (s) is/are correct about $f(x)$?

A. Domain is \mathbb{R}

B. Range is $[0, \pi]$

C. $f(x)$ is even

D. $f(x)$ is derlvable in $(\pi, 2\pi)$

Answer: A::B::C::D

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4. $|\log_e|x|| = |k - 1| - 3$ has four distict roots then k satisfies : (where $|x| < d^2, x \neq 0$)

A. $(-4, -2)$

B. $(4, 6)$

C. (e^{-1}, e)

D. (d^{-2}, e^{-1})

Answer: A::B



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5. Which of the following functions are defined for all $x \in R$? (Where $[\cdot]$ denotes greatest integer function)

A. $f(x) = \sin[x] + \cos[x]$

B. $f(x) = \sec^{-1}(1 + \sin^2 x)$

C. $f(x) = \sqrt{\frac{9}{8} + \cos x + \cos 2x}$

D. $f(x) = \tan(\ln(1 + |x|))$

Answer: A::B::C



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6. Let $f(x) = \begin{cases} x^2 & 0 < x < 2 \\ 2x - 3 & 2 \leq x < 3 \\ x + 2 & x \geq 3 \end{cases}$ then the true equations:

A. $f\left(f\left(f\left(\frac{3}{2}\right)\right)\right) = f\left(\frac{3}{2}\right)$

B. $1 + f\left(f\left(f\left(\frac{5}{2}\right)\right)\right) = f\left(\frac{5}{2}\right)$

C. $f(f(f(2))) = f(1)$

D. $\underbrace{f(f(f(\dots f(4)\dots)))}_{\text{2012 times}} = 2012$

Answer: A::B::C



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7. Let $f: \left[\frac{2\pi}{3}, \frac{5\pi}{3}\right] \rightarrow [0, 4]$ be a function defined as

$f(x) = \sqrt{3} \sin x - \cos x + 2$, then :

A. $f^{-1}(1) = \frac{4\pi}{3}$

B. $f^{-1}(1) = \pi$

$$C. f^{-1}(2) = \frac{5\pi}{6}$$

$$D. f^{-1}(2) = \frac{7\pi}{6}$$

Answer: A::D



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8. Let $f(x)$ be invertible function and let $f^{-1}(x)$ be its inverse. Let equation $f(f^{-1}(x)) = f^{-1}(x)$ has two real roots α and β (within domain of $f(x)$), then :

A. $f(x) = x$ also has same two real roots

B. $f^{-1}(x) = x$ also has same two real roots

C. $f(x) = f^{-1}(x)$ also has same two real roots

D. Area of triangle formed by $(0, 0)$, $(\alpha, f(\alpha))$, and $(\beta, f(\beta))$ is 1 unit

Answer: A::B::C



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9. In function $f(x) = \cos^{-1} x + \cos^{-1} \left(\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2} \right)$, then Range of $f(x)$ is $\left[\frac{\pi}{3}, \frac{10\pi}{3} \right]$ Range of $f(x)$ is $\left[\frac{\pi}{3}, 5\pi \right]$ $f(x)$ is one-one for $x \in \left[-1, \frac{1}{2} \right]$ $f(x)$ is one-one for $x \in \left[\frac{1}{2}, 1 \right]$

A. Range of $f(x)$ is $\left[\frac{\pi}{3}, \frac{10\pi}{3} \right]$

B. Rang $f(x)$ is $\left[\frac{\pi}{3}, \frac{5\pi}{3} \right]$

C. $f(x)$ is one-one for $x \in \left[-1, \frac{1}{2} \right]$

D. $f(x)$ is one-one for $x \in \left[\frac{1}{2}, 1 \right]$

Answer: B::C



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10. Let $f: R \rightarrow R$ defined by $f(x) = \cos^{-1}(-\{ -x \})$, where $\{x\}$ denotes fractional part of x . Then, which of the following is/are correct?

A. f is many one but not even function

B. Range of f contains two prime numbers

C. f is a periodic

D. Graph of f does not lie below x -axis

Answer: A::B::D

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11. Which option (s) is/are true ?

A. $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = e^{|x|} - e^{-x}$ is many-one into function

B. $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 2x + |\sin x|$ is one-one onto

C. $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = \frac{x^2 + 4x + 30}{x^2 - 8x + 18}$ is many-one onto

D. $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = \frac{2x^2 - x + 5}{7x^2 + 2x + 10}$ is many-one into

Answer: A::B::D

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12. If $f(x) = \left[\frac{\ln(x)}{e} + \left[\frac{\ln(e)}{x} \right] \right]$, where $[.]$ denotes greatest interger

function, the which of the following are ture ?

A. range of $h(x)$ is $\{-1, 0\}$

B. If $h(x) = -1$, then x can be rational as well as irractional

C. If $h(x) = -1$, then x can be rational as well as irrational

D. $h(x)$ is periodic function

Answer: A:C

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13. If $f(x) = \begin{cases} x^3 & x \in Q \\ -x^3 & x \notin Q \end{cases}$, then :

A. $f(x)$ is periodic

B. $f(x)$ is many-one

C. $f(x)$ is one-one

D. range of the function is \mathbb{R}

Answer: C::D



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14. Let $f(x)$ be a real valued function such that $f(0) = \frac{1}{2}$ and $f(x+y) = f(x)f(a-y) + f(y)f(a-x), \forall x, y \in \mathbb{R}$, then for some real a ,

A. $f(x)$ is periodic function

B. $f(x)$ is a constant function

C. $f(x) = \frac{1}{2}$

D. $f(x) = \frac{\cos x}{2}$

Answer: A::B::C



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15. $f(x)$ is an even periodic function with period 10. In

$$[0, 5], f(x) = \begin{cases} 2x & 0 \leq x < 2 \\ 3x^2 - 8 & 2 \leq x < 4 \\ 10x & 4 \leq x \leq 5 \end{cases}. \text{ Then:}$$

A. $f(-4) = 40$

B. $\frac{f(-13) - f(11)}{f(13) + f(-11)} = \frac{17}{21}$

C. $f(5)$ is not defined

D. Range of $f(x)$ is $[0, 50]$

Answer: A::B::D



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16. For the equation $\frac{e^{-x}}{x+1}$ which of the following statement(s) is/are correct?

A. when $\lambda \in (0, \infty)$ equation has 2 real and distinct roots

B. when $\lambda \in (-\infty, -e^2)$ equation has 2 real and distinct roots

C. when $\lambda \in (0, \infty)$ equation has 1 real root

D. when $\lambda \in (-e, 0)$ equation has no real root

Answer: B::C::D



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17. For $x \in R^+$, if $x, [x], \{x\}$ are in harmonic progression then the value of x can not be equal to (where $[*]$ denotes greatest integer function, $\{*\}$ denotes fractional part function)

A. $\frac{1}{\sqrt{2}} \tan \frac{\pi}{8}$

B. $\frac{1}{\sqrt{2}} \cot \frac{\pi}{8}$

C. $\frac{1}{\sqrt{2}} \tan \frac{\pi}{12}$

D. $\frac{1}{\sqrt{2}} \cot \frac{\pi}{12}$

Answer: A::C::D



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18. The equation $||x - 1| + a| = 4, a \in R$, has :

- A. 3 distinct real roots for unique value of a.
- B. 4 distinct real roots for $a \in (-\infty, -4)$
- C. 2 distinct real roots for $|a| < 4$
- D. no real roots for $a > 4$

Answer: A::B::C::D



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19. Let $f_n(x) = (\sin x)^{1/\pi}, x \in R$, then:

- A. $f_2(x) > 1$ for all $x \in \left(2k\pi, (4k + 1)\frac{\pi}{2}\right), k \in I$
- B. $f_2(x) = 1$ for $x = 2k\pi, k \in I$
- C. $f_2(x) > f_3(x)$ for all $x \in \left(2k\pi, (4k + 1)\frac{\pi}{2}\right), k \in I$
- D. $f_3(x) \geq f_5(x)$ for all $x \in \left(3k\pi, (4k + 1)\frac{\pi}{2}\right), k \in I$

Answer: A::B



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20. If the domain of $f(x) = \frac{1}{\pi} \cos^{-1} \left[\log_3 \left(\frac{x^3}{3} \right) \right]$ where, $x > 0$ is $[a,b]$ and the range of $f(x)$ is $[c,d]$, then :

A. a, b are the roots of the equation $x^4 - 3x^4 - 3xc^3 - x + 3 = 0$

B. a, b are the roots of the equatin $x^4 - x^3 + x^2 - 2x + 1 = 0$

C. $a^3 + d^3 = 1$

D. $a^2 + b^2 + c^2 = 11$

Answer: A::D



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21. The number of real values of x satisfying the equation

; $\left[\frac{2x + 1}{3} \right] + \left[\frac{4x + 5}{6} \right] = \frac{3x - 1}{2}$ are greater than or equal to $\{[*]$

denotes greatest integer function):

A. 7

B. 8

C. 9

D. 10

Answer: A::B::C



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22. Let $f(x) = \sin^6\left(\frac{x}{4}\right) + \cos^6\left(\frac{x}{4}\right)$. If $f^n(x)$ denotes n^{th} derivative of f evaluated at x . Then which of the following hold ?

A. $f^{2014}(0) = -\frac{3}{8}$

B. $f^{2015}(0) = \frac{3}{8}$

C. $f^{2010}\left(\frac{\pi}{2}\right) = 0$

D. $f^{2011}\left(\frac{\pi}{2}\right) = \frac{3}{8}$

Answer: A::C::D



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23. Which of the following is (are) incorrect ?

A. If $f(x) = \sin x$ and $g(x) = \ln x$ then range of $g(f(x))$ is $[-1, 1]$

B.

C. If $f(x) = (2011 - x^{2012})^{\frac{1}{2012}}$ then $f(f(2)) = \frac{1}{2}$

D. The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = \frac{x^2 + 4x + 30}{x^2 - 8x + 18}$ is not surjective.

Answer: A::B



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24. If $[x]$ denotes the integral part of x for real x , and

$$S = \left[\frac{1}{4} \right] + \left[\frac{1}{4} + \frac{1}{200} \right] + \left[\frac{1}{4} + \frac{1}{100} \right] + \left[\frac{1}{4} + \frac{3}{200} \right] \dots + \left[\frac{1}{4} + \frac{199}{200} \right]$$

then S is



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25. Let $f(x) = \log_{\{x\}} [x]$

$$g(x) = \log_{\{x\}} - \{x\}$$

$$h(x) \log_{\{x\}} \{x\}$$

where $[], \{ \}$ denotes the greatest integer function and fractional part function respectively.

For $x \in (1, 5)$ the $f(x)$ is not defined at how many points :

A. 5

B. 4

C. 3

D. 2

Answer: C



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Comprehension Type Problems

1. Let $f(x) = \log_{\{x\}} [x]$

$$g(x) = \log_{\{x\}} - \{x\}$$

$$h(x) \log_{\{x\}} \{x\}$$

where $[], \{ \}$ denotes the greatest integer function and fractional part function respectively.

If $A = \{x : x \in \text{domine of } f(x)\}$ and $B = \{x : x \text{ domine of } g(x)\}$ then

$\forall x \in (1, 5), A - B$ will be :

A. (2, 3)

B. (1, 3)

C. (1, 2)

D. None of these

Answer: D



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2. Let $f(x) = \log_{\{x\}} [x]$

$$g(x) = \log_{\{x\}} - \{x\}$$

$$h(x) \log_{\{x\}} \{x\}$$

where $[]$, $\{ \}$ denotes the greatest integer function and fractional part function respectively.

Domine of $h(x)$ is :

- A. $[2, \infty)$
- B. $[1, \infty)$
- C. $[2, \infty) - \{I\}$
- D. $R^+ - \{I\}$

Answer: C



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3. θ is said to be well behaved if it lies in interval $\left[0, \frac{\pi}{2}\right]$. They are intelligent if they make domain of $f + g$ and g equal. The vlaue of θ for

which $h(\theta)$ is defined are handsome. Let

$$f(x) = \sqrt{\theta x^2 - 2(\theta^2 - 3)x - 12\theta}, g(x) = \ln(x^2 - 49),$$

$$h(\theta) \ln \left[\int_0^\theta 4 \cos^2 t dt - \theta^2 \right], \text{ where } \theta \text{ is in radians.}$$

Complete set of values of θ which are well behaved as well as intelligent is:

A. $\left[\frac{3}{4}, \frac{\pi}{2} \right]$

B. $\left[\frac{3}{5}, \frac{7}{8} \right]$

C. $\left[\frac{5}{6}, \frac{\pi}{2} \right]$

D. $\left[\frac{6}{7}, \frac{\pi}{2} \right]$

Answer: D



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4. θ is said to be well behaved if it lies in interval $\left[0, \frac{\pi}{2} \right]$. They are intelligent if they make domain of $f + g$ and g equal. The value of θ for which $h(\theta)$ is defined are handsome. Let

$$f(x) = \sqrt{\theta x^2 - 2(\theta^2 - 3)x - 12\theta}, g(x) = \ln(x^2 - 49),$$

$$h(\theta) \ln \left[\int_0^\theta 4 \cos^2 t dt - \theta^2 \right], \text{ where } \theta \text{ is in radians.}$$

Complete set of values of θ which are intelligent is :

A. $\left[\frac{6}{7}, \frac{7}{2} \right]$

B. $\left(0, \frac{\pi}{3} \right]$

C. $\left[\frac{1}{4}, \frac{6}{7} \right]$

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

Answer: A



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5. θ is said to be well behaved if it lies in interval $\left[0, \frac{\pi}{2} \right]$. They are intelligent if they make domain of $f + g$ and g equal. The value of θ for which $h(\theta)$ is defined are handsome. Let

$$f(x) = \sqrt{\theta x^2 - 2(\theta^2 - 3)x - 12\theta}, g(x) = \ln(x^2 - 49),$$

$$h(\theta) \ln \left[\int_0^\theta 4 \cos^2 t dt - \theta^2 \right], \text{ where } \theta \text{ is in radians.}$$

Complete set of values of θ which are well behaved, intelligent and handsome is :

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

B. $\left[\frac{6}{7}, \frac{\pi}{2}\right]$

C. $\left[\frac{3}{4}, \frac{\pi}{2}\right]$

D. $\left[\frac{3}{5}, \frac{\pi}{2}\right]$

Answer: B



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6. Let $f(x) = 2 - |x - 3|$, $1 \leq x \leq 5$ and for rest of the values $f(x)$ can be obtained by using the relation $f(5x) = \alpha f(x) \forall x \in R$ The maximum value of $f(x)$ in $[5^4, 5^5]$ for $\alpha = 2$ is

A. 16

B. 32

C. 64

D. 8

Answer: B



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7. Let $f(x) = 2 - |x - 3|$, $1 \leq x \leq 5$ and for rest of the values $f(x)$ can be obtained by using the relation $f(5x) = \alpha f(x) \forall x \in R$.

The value of $f(2007)$, taking $\alpha = 5$, is :

A. 1118

B. 2007

C. 1050

D. 132

Answer: A



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8. An even periodic function $f: \mathbb{R} \rightarrow \mathbb{R}$ with period 4 is such that

$$f(x) = \begin{cases} \max(|x|, x^2) & 0 \leq x < 1 \\ x & 1 \leq x \leq 2 \end{cases}$$

The value of $\{f(5.12)\}$ (where $\{.\}$ denotes fractional part function), is :

A. $\{f(3.26)\}$

B. $\{f(7.88)\}$

C. $\{f(2.12)\}$

D. $\{f(5.88)\}$

Answer: B



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9. An even periodic function $f: \mathbb{R} \rightarrow \mathbb{R}$ with period 4 is such that

$$f(x) = \begin{cases} \max(|x|, x^2) & 0 \leq x < 1 \\ x & 1 \leq x \leq 2 \end{cases}$$

The number of solutions of $f(x) = 3 \sin x$ for $x \in (-6, 6)$ are :

A. 5

B. 3

C. 7

D. 9

Answer: C



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10. Let $f(x) = \frac{2|x| - 1}{x - 3}$

Range of $f(x)$:

A. $R - \{3\}$

B. $\left(-\infty, \frac{1}{3}\right] \cup (2, \infty)$

C. $\left(-2, \frac{1}{3}\right] \cup (2, \infty)$

D. R

Answer: B



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11. Let $f(x) = \frac{2|x| - 1}{x - 3}$

Range of the values of 'k' for which $f(x) = k$ has exactly two distinct solutions:

A. $\left(-2, \frac{1}{3}\right)$

B. $(-2, 1]$

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

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

Answer: A



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12. Let $f(x)$ be a continuous function (define for all x) which satisfies

$$f^3(x) - 5f^2(x) + 10f(x) - 12 \geq 0, f^2(x) + 3 \geq 0 \text{ and } f^2(x) - 5f(x) +$$

If distinct positive number b_1, b_2 and b_3 are in G.P. then

$f(1) + \ln b_1, f(2) + \ln b_2, f(3) + \ln b_3$ are in :

A. A.P.

B. G.P.

C. H. P.

D. A. G. P.

Answer: A



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13. Let $f(x)$ be a continuous function (define for all x) which satisfies $f^3(x) - 5f^2(x) + 10f(x) - 12 \geq 0$, $f^2(x) + 3 \geq 0$ and $f^2(x) - 5f(x) + 6 \geq 0$. The equation of tangent that can be drawn from $(2, 0)$ on the curve $y = x^2 f(\sin x)$ is :

A. $y = 24(x + 2)$

B. $y = 12(x + 2)$

C. $y = 24(x - 2)$

D. $y = 12(x - 2)$

Answer: C

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14. Let $f: [2, \infty) \rightarrow \{1, \infty)$ defined by $f(x) = 2^{x^4 - 4x^3}$ and $g: \left[\frac{\pi}{2}, \pi\right] \rightarrow A$ defined by $g(x) = \frac{\sin x + 4}{\sin x - 2}$ be two invertible functions, then

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

A. $\sqrt{2 + \sqrt{4 - \log_2 x}}$

B. $\sqrt{2 + \sqrt{4 + \log_2 x}}$

C. $\sqrt{4 + \sqrt{4 + \log_2 x}}$

D. $\sqrt{4 - \sqrt{2 + \log_2 x}}$

Answer: B

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15. Let $f: [2, \infty) \rightarrow \{1, \infty\}$ defined by $f(x) = 2^{x^4 - 4x^3}$ and $g: \left[\frac{\pi}{2}, \pi\right] \rightarrow A$ defined by $g(x) = \frac{\sin x + 4}{\sin x - 2}$ be

two invertible functions, then

The set "A" equals to

- A. $[5, 2]$
- B. $[-2, 5]$
- C. $[-5, 2]$
- D. $[-5, -2]$

Answer: D

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Matching Type Problems

1. Let $f(x) = \begin{cases} 1 + x, & 0 \leq x \leq 2 \\ 3 - x, & 2 < x \leq 3 \end{cases}$

find (fof) (x).



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Subjective Type Problems

1. Let $f(x)$ be a polynomial of degree 6 with leading coefficient 2009. Suppose further that $f(1) = 1$, $f(2) = 3$, $f(3) = 5$, $f(4) = 7$, $f(5) = 9$, $f'(2) = 2$. Then the sum of all the digits of $f(6)$ is



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2. If $f(x) = x^3 - 3x + 1$, then the number of distinct real roots of the equation $f(f(x)) = 0$ is



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3. If $f(x + y + 1) = \left\{ \sqrt{f(x)} + \sqrt{f(y)} \right\}^2$ and $f(0) = 1 \forall x, y \in \mathbb{R}$, determine $f(n)$, $n \in \mathbb{N}$.

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4. If the domain of $f(x) = \sqrt{12 - 3^x - 3^{3-x}} + \sin^{-1}\left(\frac{2x}{3}\right)$ is $[a, b]$, then $a = \dots\dots$

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5. The number of elements in the range of functions: $y = \sin^{-1}\left[x^2 + \frac{5}{9}\right] + \cos^{-1}\left[x^2 - \frac{4}{9}\right]$ where $[.]$ denotes the greatest integer function is:

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6. The number of integers in the range of function $f(x) = [\sin x] + [\cos x] + [\sin x + \cos x]$ is (where $[.] =$ denotes greatest integer function)

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7. If $P(x)$ is polynomial of degree 4 such that $P(-1) = P(1) = 5$ and $P(-2) = P(0) = P(2) = 2$ find the maximum value of $P(x)$.



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8. The number of integral value (s) of k for which the curve $y = \sqrt{-x^2 - 2x}$ and $x + y - k = 0$ intersect at 2 distinct points is/are



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9. Let the solution set of the equation $\sqrt{\left[x + \left[\frac{x}{2}\right]\right]} + \left[\sqrt{\{x\}} + \left[\frac{x}{3}\right]\right] = 3$ is $[a, b)$. Find the product ab . (where $[\cdot]$ and $\{\cdot\}$ denote greatest integer and fractional part function, respectively).



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10. For the real number x , let $f(x) = \frac{1}{2011\sqrt{1-x^{2011}}}$. Find the number of real roots of the equation

$$f(f(\dots(f(x))\dots)) = (\{ - x \}$$

where f is applied 2013 times and $\{ \cdot \}$ denotes fractional part function.

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11. Find the number of elements contained in the range of the function

$f(x) = \left[\frac{x}{6} \right] \left[\frac{-6}{x} \right] \forall x \in (0, 30]$ where $[\cdot]$ denotes greatest integer function)

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12. Let $f(x, y) = x^2 - y^2$ and $g(x, y) = 2xy$. such that $(f(x, y))^2 - (g(x, y))^2 = \frac{1}{2}$ and $f(x, y) \cdot G(x, y) = \frac{\sqrt{3}}{4}$ Find the number of ordered pairs (x, y) ?

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13. Let $f(x) = \frac{x+5}{\sqrt{x^2+1}}$, then the smallest integral value of k for which

$$f(x) \leq k \forall x \in R \text{ is}$$

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14. The number of integral values of m for which

$f: R \rightarrow R, f(x) = \frac{x^2}{3} + (m-1)x^2 + (m+5)x + n$ is bijective is :

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15. The number of roots of equation

$$\left(\frac{(x-1)(x-3)}{(x-2)(x-4)} - e^x \right) \left(\frac{(x+1)(x+3)e^x}{(x+2)(x+4)} - 1 \right) (x^3 - \cos x) = 0:$$

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16. Let $f(x) = x^2 - bx + c$, b is an odd positive integer. Given that $f(x)=0$

has two prime numbers as roots and $b+c=35$. If the least value of

$f(x) \forall x \in R$ is λ , then $\left\lceil \left\lfloor \frac{\lambda}{3} \right\rfloor \right\rceil$ is equal to (where $[.]$ denotes greatest integer function)

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17. Let $f(x)$ be a continuous function such that $f(0) = 1$ and $f(x) = f\left(\frac{x}{7}\right) = \frac{x}{7} \forall x \in R$, then $f(42)$ is

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18. If $f(x) = 4x^3 - x^2 - 2x + 1$ and $g(x) = \begin{cases} \min \{f(t) : 0 \leq t \leq x\} & 0 \leq x < 1 \\ 3 - x & 1 < x \end{cases}$
and if $\lambda = g\left(\frac{1}{4}\right) + g\left(\frac{3}{4}\right) + g\left(\frac{5}{4}\right)$, then $2\lambda =$

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19. If $x = 10 \sum_{r=3}^{100} \frac{1}{(r^2 - 4)}$, then $[x] =$

(where $[.]$ denotes greatest integer function)

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20. Let $f(x) = \frac{ax + b}{cx + d}$, where a, b, c, d are non zero. If $f(7) = 7$, $f(11) = 11$ and $f(f(x)) = x$ for all x except $-\frac{d}{c}$. The unique number which is not in the range of f is

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21. Let $A = \{x \mid x^2 - 4x + 3 < 0, x \in \mathbb{R}\}$
 $B = \{x \mid 2^{1-x} + p \leq 0; x^2 - 2(p+7)x + 5 \leq 0\}$ If $A \subset B$, then the range of real number $p \in [a, b]$ where a, b are integers. Find the value of $(b - a)$.

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22. Let the maximum value of expression $y = \frac{x^4 - x^2}{x^6 + 2x^3 - 1}$ for $x > 1$ is $\frac{p}{q}$, where p and q are relatively prime natural numbers, then $p + q =$

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23. If $f(x)$ is an even function then find the number of distinct real numbers x such that $f(x) = f\left(\frac{x+1}{x+2}\right)$.

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24. The least integral value of m , $m \in \mathbb{R}$ for which the range of function $f(x) = \frac{x+m}{x^2+1}$ contains the interval $[0, 1]$ is :

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25. Let x_1, x_2, x_3 satisfying the equation $x^3 - x^2 + \beta x + \gamma = 0$ are in GP where $(x_1, x_2, x_3 > 0)$, then the maximum value of $[\beta] + [\gamma] + 2$ is, $[.]$ is greatest integer function.

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26. The value of $\sum_{r=1}^{1024} [\log_2 r]$ is equal to, ($[.]$ denotes the greatest integer function)

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27. Let $f(x) = \frac{ax + b}{cx + d}$, where a, b, c, d are non zero. If $f(7) = 7, f(11) = 11$ and $f(f(x)) = x$ for all x except $-\frac{d}{c}$. The unique number which is not in the range of f is

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28. It is pouring down rain and the amount of rain hitting point (x, y) is given by $f(x, y) = |x^3 + 2x^2y - 5xy^2 - 6y^3|$. If Mr. 'A' starts at $(0, 0)$, find number of possible value (s) for 'm' such that $y = mx$ is a line along which Mr. 'A' could walk without any rain falling on him.

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29. Let $P(x)$ be a cubic polynomial with leading coefficient unity. Let the remainder when $P(x)$ is divided by $x^2 - 5x + 6$ equals 2 times the remainder when $P(x)$ is divided by $x^2 - 5x + 4$. If $P(0) = 100$, find the sum of the digits of $P(5)$,

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30. Let $f(x) = x^2 + 10x + 20$. Find the number of real solution of the equation $f(f(f(f(x)))) = 0$

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31. If range of $f(x) = \frac{(\ln x)(\ln x^2) + \ln x^3 + 3}{\ln^2 x + \ln x^2 + 2}$ can be expressed as $\left[\frac{a}{b}, \frac{c}{d}\right]$ where a,b,c and d are prime numbers (not necessarily distinct) then find the value of $\frac{(a + b + c + d)}{2}$.

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32. Polynomial $P(x)$ contains only terms of odd degree. when $P(x)$ is divided by $(x - 3)$, the remainder is 6. If $P(x)$ is divided by $(x^2 - 9)$ then remainder is $g(x)$. Then find the value of $g(2)$.

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33. The equation $2x^3 - 3x^2 + p = 0$ has three real roots. Then find the minimum value of p.

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34. Find the number of integers in the domain of $f(x) = \frac{1}{\sqrt{\ln \cos^{-1} x}}$

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