



## MATHS

### BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

#### REAL FUNCTIONS

#### Illustration

1. If  $f(x) = x + \frac{1}{x}$ , such that  $f^3(x) = f(x^3) + \lambda f\left(\frac{1}{x}\right)$ , then  $\lambda =$

A. 1

B. 3

C. -3

D. -1

**Answer: B**





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2. If  $y = f(x) = \frac{(x + 2)}{(x - 1)}$ , then  $x = f(y)$  (b)  $f(1) = 3$   $y$  increases with  $x$  for  $x < 1$   $f$  is a rational function of  $x$

A.  $x=f(y)$

B.  $f(1)=3$

C.  $y$  increases with  $x$  for  $x < 1$

D.  $f$  is a rational function of  $x$

Answer: A



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3. If  $f(x) = \cos(\log x)$ , then  $f(x)f(y) - \frac{1}{2} \left[ f\left(\frac{x}{y}\right) + f(xy) \right] =$

A. 1

B. 0

C. -1

D. none of these

**Answer: B**



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4. Let  $a, b, c \in \mathbb{R}$ . If  $f(x) = ax^2 + bx + c$  is such that  $a+b+c=3$

$f(x+y) = f(x) + f(y) + xy \forall x, y \in \mathbb{R}$  then  $\sum_{n=1}^{10} f(n)$  is equal to

A. 190

B. 255

C. 330

D. 165

**Answer: C**



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5. if for nonzero  $x$ ,  $af(x) + bf\left(\frac{1}{x}\right) = \frac{1}{x} - 5$ , where  $a \neq b$  then  $f(2) =$

A.  $\frac{3(2b + 3a)}{2(a^2 - b^2)}$

B.  $\frac{3(2b - 3a)}{2(a^2 - b^2)}$

C.  $\frac{3(3a - 2b)}{2(a^2 - b^2)}$

D.  $\frac{6}{a + b}$

**Answer: B**



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6. If  $af(x + 1) + bf\left(\frac{1}{x + 1}\right) = x$ ,  $x \neq -1$ ,  $a \neq b$ , then  $f(2)$  is equal

to

A.  $a + b$

B.  $a^2 - b^2$

C.  $\frac{1}{a + b}$

D. none of these

**Answer: D**



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7. If  $f(x)$  is defined on  $[0, 1]$  by the rule  $f(x) = \begin{cases} x, & \text{if } x \text{ is rational} \\ 1 - x, & \text{if } x \text{ is irrational} \end{cases}$  then for all  $x \in [0, 1]$ ,  $f(f(x))$  is

A.  $x$

B.  $-x$

C.  $1 + x$

D.  $1-x$

**Answer: A**



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8. If  $f(x)$  is a polynomial satisfying  $f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$  and  $f(3) = 28$  then  $f(4) =$

A. 63

B. 65

C. 66

D. 27

**Answer: B**



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9. If  $g(x)$  is a polynomial satisfying  $g(x)g(y) = g(x) + g(y) + g(xy) - 2$  for all real  $x$  and  $y$  and  $g(2) = 5$  then  $\lim_{x \rightarrow 3} g(x)$  is

A. 6

B. 25

C. 24

**Answer: D**



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10. If  $3f(x) - f\left(\frac{1}{x}\right) = \log_e x^4$  for  $x > 0$ , then

$f(e^x) =$

A.  $x$

B.  $\log_e x$

C.  $e^x$

D. none of these

**Answer: A**



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11. If  $f(x) + 2f\left(\frac{1}{x}\right) = 3x$ ,  $x \neq 0$ , and  $S = \{x \in \mathbb{R} : f(x) = f(-x)\}$ ,

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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12. If  $f(x) = \frac{x}{x-1}$ , then  $(\underbrace{f \circ f \circ f \circ \dots \circ f}_{19 \text{ times}})(x)$  is equal to

- A.  $\frac{x}{x-1}$
- B.  $\left(\frac{x}{x-1}\right)^{19}$
- C.  $\frac{19x}{x-1}$



D.  $x$

**Answer: A**

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13. For  $x \in \mathbb{R}, x \neq 0, 1$ , let  $f_0(x) = \frac{1}{1-x}$  and  $f_{n+1}(x) = f_0(f_n(x)), n = 0, 1, 2, \dots$ . Then the value of  $f_{100}(3) + f_1\left(\frac{2}{3}\right) + f_2\left(\frac{3}{2}\right)$  is equal to

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

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

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

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

**Answer: C**

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14. Let  $f$  be a real valued function satisfying  $f(x + y) = f(x) + f(y)$  for

all  $x, y \in R$  and  $f(1) = 2$ . Then  $\sum_{k=1}^n f(k) =$

A.  $\frac{n(n+1)}{2}$

B.  $n(n+1)$

C.  $(n+1)$

D.  $n$

**Answer: B**



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15. Let  $f$  be a real valued function satisfying

$f(x + y) = f(x)f(y)$  for all  $x, y \in R$  such that  $f(1) = 2$ .

Then,  $\sum_{k=1}^n f(k) =$

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

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

C.  $2^n - 1$ )

D.  $2^n - 2$

**Answer: A**



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16. Let  $f$  be a real valued function satisfying  $f(x + y) = f(x)f(y)$  for all  $x, y \in \mathbb{R}$  such that  $f(1)=2$ .

If  $\sum_{k=1}^n f(a + k) = 16(2^n - 1)$ , then  $a=$

A. 3

B. 4

C. 2

D. none of these

**Answer: A**



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17. Let  $f: R \rightarrow R$  be given by

$$f\left(x + \frac{5}{6}\right) + f(x) = f\left(x + \frac{1}{2}\right) + f\left(x + \frac{1}{3}\right) \text{ for all } x \in R. \text{ Then ,}$$

A.  $f(x)$  is periodic

B.  $f(x)$  is even

C.  $f(x + 2) - f(x + 1) = f(x + 1) - f(x)$

D. none of these

**Answer: C**



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18. A real valued function  $f(x)$  satisfies the functional equation

$$f(x - y) = f(x)f(y) - f(a - x)f(a + y), \text{ where } a \text{ is a given constant}$$

and  $f(0), f(2a-x) =$

A.  $f(-x)$

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

C.  $f(x)$

D.  $-f(x)$

**Answer: D**



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19. The domain [प्रान्त] of the function  $f(x) = \sqrt{x - \sqrt{1 - x^2}}$  is

A.  $[1, -1/\sqrt{2}] \cup [1/\sqrt{2}, 1]$

B.  $[-1,1]$

C.  $(-\infty, -1/2) \cup [1/\sqrt{2}, \infty)$

D.  $[1/\sqrt{2}, 1]$

**Answer: D**



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20. The domain [प्रान्त] of the function  $f(x) = \sqrt{1 - \sqrt{1 - \sqrt{1 - x^2}}}$ , is

A.  $(-\infty, 1)$

B.  $(-1, \infty)$

C.  $[0, 1]$

D.  $[-1, 1]$

**Answer: D**



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21. The domain [प्रान्त] of the function

$$f(x) = \sqrt{x^2 - 5x + 6} + \sqrt{2x + 8 - x^2}, \text{ is}$$

A.  $[2, 3]$

B.  $[-2, 4]$

C.  $[-2, 2] \cup [3, 4]$

D.  $[-2, 1] \cup [2, 4]$

Answer: C



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22. The domain of definition of the function

$$f(x) = \frac{1}{\sqrt{x^{12} - x^9 + x^4 - x + 1}}, \text{ is}$$

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

B.  $(1, \infty)$

C.  $(-1, 1)$

D.  $\mathbb{R}$

Answer: D



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23. The domain [प्रान्त] of  $f(x) = \frac{1}{\sqrt{[x]^2 - [x] - 6}}$ , is [.] = GIF

A.  $(-\infty, -2) \cup [4, \infty)$

B.  $(-\infty, -2] \cup [4, \infty)$

C.  $(-\infty, -2) \cup (4, \infty)$

D. none of these

**Answer: A**

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**24.** Find the domain of

$$f(x) = \sqrt{\frac{1 - |x|}{2 - |x|}}, \text{ is}$$

A.  $(-\infty, \infty) - [-2, 2]$

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

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

D. none of these

**Answer: C**





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25. The range [ परिसर ] of the function  $f(x) = \frac{x}{1+x^2}$  is

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

**Answer: B**



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26. The range of the function  $f(x) = x^2 + \frac{1}{x^2 + 1}$  is

- A.  $[1, \infty)$
- B.  $[2, \infty)$
- C.  $[3/2, \infty)$

D. none of these

**Answer: A**



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27. Range of the function  $f(x) = \frac{1 + x^2}{x^2}$  is equal to

A. (0,1)

B. [0,1]

C. (1,  $\infty$ )

D. [1,  $\infty$ )

**Answer: C**



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28. Range of the function  $f(x) = \frac{x^2 - 3x + 2}{x^2 + x - 6}$  is

A.  $R - \{1/5, 1\}$

B.  $R - \left\{ \frac{1}{5} \right\}$

C.  $R - \{1\}$

D.  $R$

**Answer: A**

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29. Range[परिसर] of the function  $f(x) = \log_e \sqrt{4 - x^2}$  is

A.  $(0, \infty)$

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

C.  $(-\infty, \log_e 2]$

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

**Answer: C**

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30. If  $f(x) = \cos[\pi^2]x + \cos[-\pi^2]x$ , where  $[x] = \text{GIF}$ , then

A.  $f\left(\frac{\pi}{2}\right) = -1$

B.  $f(\pi) = 1$

C.  $f(-\pi) = -1$

D.  $f\left(\frac{\pi}{4}\right) = 2$

**Answer: A**



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31. Let  $f(x) = [x^2] + [x + 2] - 8$ , where  $[x]$  denotes the greater integer than or equal to  $x$ , then

A.  $f(x) \neq 0$  for all  $x \in R$

B.  $f(x) = 0$  only for two real values of  $x$

C.  $f(x) = 0$  for infinity many values of  $x$

D. none of these

**Answer: C**



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**32.** For a real number  $x$ ,  $[x]$  denotes greatest integer function, then find

value of  $\left[ \frac{1}{2} \right] + \left[ \frac{1}{2} + \frac{1}{100} \right] + \left[ \frac{1}{2} + \frac{2}{100} \right] + \dots + \left[ \frac{1}{2} + \frac{99}{100} \right]$

A. 49

B. 50

C. 48

D. 51

**Answer: B**



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33. Prove that for  $n = 1, 2, 3, \dots$

$$\left[ \frac{n+1}{2} \right] + \left[ \frac{n+2}{4} \right] + \left[ \frac{n+4}{8} \right] + \left[ \frac{n+8}{16} \right] + \dots = n \quad \text{where } [x]$$

represents Greatest Integer Function

- A.  $n$
- B.  $n-1$
- C.  $n+1$
- D.  $n+2$

**Answer: A**



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34. If  $f(x)$  and  $[x]$  denote respectively the fractional and integral parts of a real number  $x$ , then the number of solution of the equation  $4\{x\} = x + [x]$ , is

- A. 1
- B. 2

C. 3

D. infinitely many

**Answer: B**



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35. The number of integral solutions of the equation  $\{x+1\}+2x=4[x+1]-6$ , is

A. 0

B. 1

C. 2

D. 3

**Answer: B**



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36.

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 (i)  $x$  (ii)  $1$  (iii)  $f(x)$  (iv)  $g(x)$

A.  $x$

B.  $1$

C.  $f(x)$

D.  $g(x)$

**Answer: B**



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37. The domain of function  $f(x) = \frac{\cos^{-1} x}{[x]}$ ;  $[x] = GIF$  is:

A.  $[-1, 1]$

B.  $[-1, 1] - \{0\}$

C.  $[-1, 0) \cup \{1\}$



D.  $[-1, 0)$

**Answer: C**



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**38.** The domain of the function

$$f(x) = \frac{1}{\sqrt{|x|} - x}, \text{ is}$$

A.  $(0, \infty)$

B.  $(-\infty, 0)$

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

D. none of these

**Answer: B**



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39. Find domain of the function  $f(x) = \frac{1}{\log_{10}(1-x)} + \sqrt{x+2}$

A.  $[-2, 1)$

B.  $[-2, \infty)$

C.  $(-\infty, 1)$

D.  $[-2, 0) \cup (0, 1)$

**Answer: D**



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40. Find the domain of the function

$$f(x) = \sqrt{1-2x} + 3 \sin^{-1}\left(\frac{3x-1}{2}\right)$$

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

B.  $(-\infty, 1/2]$

C.  $[-1/3, 1/2]$

D.  $[-1/3, 1/2)$

**Answer: C**



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41. The domain of the function  $\psi(x) = \frac{1}{x} + 2^{\sin^{-1}x} + \frac{1}{\sqrt{x-2}}$  is

A.  $[-1,1]$

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

C.  $[-1, 0) \cup (0, 1]$

D. none of these

**Answer: D**



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42. The domain of definition of the function

$$f(x) = \sin^{-1} \left\{ \log_2 \left( \frac{x^2}{2} \right) \right\}, \text{ is}$$

- A.  $[-2, -1]$
- B.  $[1, 2[$
- C.  $[-2, -1] \cup [1, 2]$
- D. none of these

**Answer: C**



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43. The domain of the function

$$f(x) = \sqrt{\log_2 \sin x}, \text{ is}$$

- A.  $\left\{ (2n + 1) \frac{\pi}{2} : n \in \mathbb{Z} \right\}$
- B.  $\left\{ \frac{(4n + 1)\pi}{2} : n \in \mathbb{Z} \right\}$
- C.  $\left\{ (3n - 1) \frac{\pi}{2} : n \in \mathbb{Z} \right\}$

D.  $\left\{ \frac{n\pi}{2} : n \in \mathbb{Z} \right\}$

**Answer: B**



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**44.** Find the domain of function

$$f(x) = (\log)_4 [(\log)_5 \{(\log)_3 (18x - x^2 - 77)\}]$$

A. (8,10)

B. [8,10]

C.  $(-\infty, 8]$

D.  $[10, \infty)$

**Answer: A**



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45. The function  $f(x) = x - [x]$  is a periodic with period.

A. 1

B. 2

C. 3

D. none of these

**Answer: A**



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46. Let  $f(x)$  be periodic and  $k$  be a positive real number such that  $f(x + k) + f(x) = 0$  for all  $x \in R$ . Prove that  $f(x)$  is periodic with period  $2k$ .

A.  $k$

B.  $2k$

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

D. none of these

**Answer: B**



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47. 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. 6

B. 8

C. 10

D. 12

**Answer: D**



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48. The function  $f(x)$  satisfies the equation

$$f(x + 1) + f(x - 1) = \sqrt{3}f(x).$$
 then the period of  $f(x)$  is

A. 2

B. 6

C. 12

D. 4

**Answer: C**



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49. Let  $f(x)$  be a real valued periodic function with domain  $R$  such that

$$f(x + p) = 1 + \left[ 2 - 3f(x) + 3(f(x))^2 - (f(x))^3 \right]^{1/3}$$
 hold good for all

$x \in R$  and some positive constant  $p$ , then the periodic of  $f(x)$  is

A.  $p$

B.  $3p$



C.  $2p$

D.  $p^2$

**Answer: C**

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**50.** The period of the function

$$f(x) = |\sin x| - |\cos x|, \text{ is}$$

A.  $\pi/2$

B.  $\pi$

C.  $2\pi$

D. none of these

**Answer: B**

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51. The period of the function

$$f(x) = ||\sin x| - |\cos x| |, \text{ is}$$

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

B.  $\pi$

C.  $2\pi$

D. none of these

**Answer: A**



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52. If  $f(x) = \sin x + \cos ax$  is a periodic function, show that  $a$  is a rational number

A.  $a \in \mathbb{Z}$

B.  $a \in \mathbb{N}$

C.  $a \in \mathbb{Q}$

D.  $a \in R$

**Answer: C**



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**53.** The period of  $\cos x^2$  is

A.  $\pi$

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

C.  $2\pi$

D. None

**Answer: D**



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54. Let  $f$  be a real valued periodic function defined for all real numbers  $x$  such that for some fixed  $a > 0$ ,  $f(x + a) = \frac{1}{2} + \sqrt{f(x) - \{f(x)\}^2}$  for all  $x$ .

Then, the period of  $f(x)$  is

A.  $a$

B.  $2a$

C.  $3a$

D.  $4a$

**Answer: B**



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55. Let  $f(x, y)$  be a periodic function satisfying  $f(x, y) = f(2x + 2y, 2y - 2x)$  for all  $x, y$ ; Define  $g(x) = f(2^x, 0)$ . Show that  $g(x)$  is a periodic function with period 12.

A. 2

B. 4

C. 6

D. 12

**Answer: D**



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56. If  $f: \overrightarrow{RR}$  is a function satisfying the property  $f(2x + 3) + f(2x + 7) = 2 \forall x \in R$ , then find the fundamental period of  $f(x)$ .

A. 2

B. 4

C. 8

D. 12

**Answer: C**



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**57.** If  $f$  is a periodic function and  $g$  is a non-periodic function, then

- A.  $f \circ g$  is always periodic
- B.  $g \circ f$  is never periodic
- C.  $g \circ f$  is always periodic
- D. none of these

**Answer: C**



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**58.** Let  $f: R \rightarrow R$ , be a periodic function such that  $\{f(x) : x \in N\}$  is an infinite set then, the period of  $f(x)$  cannot be

A. a rational

B. an irrational

C.  $e$

D.  $\pi$

**Answer: A**

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**59.** The period of  $\sin^2 x$ , is

A.  $2\pi$

B.  $\pi$

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

D.  $4\pi$

**Answer: B**

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60. The period of  $|\cos x|$ , is

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

B.  $2\pi$

C.  $\pi$

D. none of these

**Answer: C**



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61. the period of the  $f(x) = \sin^4 x + \cos^4 x$  is

A.  $\pi$

B.  $2\pi$

C.  $4\pi$



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

**Answer: D**



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62. The period of  $f(x) = \sin\left(\frac{\sin(x)}{5}\right)$ , is

A.  $2\pi$

B.  $\frac{2\pi}{5}$

C.  $10\pi$

D.  $\pi$

**Answer: C**



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63. The periodic function  $f(x) = a \sin \lambda x + b \cos \lambda x$  is

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

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

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

D.  $\frac{\pi}{|\lambda|}$

**Answer: C**



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64. The period of  $f(x) = \sin \frac{2\pi x}{3} + \cos \frac{\pi x}{2}$ , is

A. 3

B. 4

C. 6

D. 12

**Answer: D**



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65. Find the period of

$$f(x) = \sin x + \frac{\tan x}{2} + \frac{\sin x}{2^2} + \tan \frac{x}{2^3} + \frac{\sin x}{2^{n-1}} + \frac{\tan x}{2^n}$$

A.  $2\pi$

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

C.  $2^n\pi$

D.  $n\pi$

Answer: C



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66. The period of  $f(x) = 5 \sin 3x - 7 \sin 8x$ , is

A.  $\pi$

B.  $2\pi$

C.  $3\pi$

D.  $8\pi$

**Answer: B**



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67. The period of  $f(x) = \tan 3x + \cos \frac{5x}{2}$ , is

A.  $2\pi$

B.  $6\pi$

C.  $4\pi$

D.  $10\pi$

**Answer: C**



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68. The period of  $f(x) = \cos x + \{x\}$ , is

A.  $2\pi$

B. 1

C.  $\pi$

D. none- existent

**Answer: D**

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**69.** Identify the correct statement the fundamental period of

$$f(x) = \cos(\sin x) + \cos(\cos x) \text{ is } \pi$$

A.  $\pi$

B.  $2\pi$

C.  $\pi/2$

D.  $4\pi$

**Answer: C**



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70. The period of the function  $f(x) = |\sin x| + |\cos x|$  is

A.  $\pi$

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

C.  $2\pi$

D. none of these

Answer: B



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71. The period of

$$f(x) = \frac{1}{2} \left\{ \frac{|\sin x|}{\cos x} + \frac{|\cos x|}{\sin x} \right\}, \text{ is}$$

A.  $\pi$

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

C.  $2\pi$

D. none of these

**Answer: C**



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72. The function  $f(x) = \sin^{-1}(\sin x)$ , is

A. periodic with period  $2\pi$

B. periodic with period  $\pi$

C. periodic with period  $\frac{\pi}{2}$

D. non-periodic

**Answer: A**



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73. Let  $[x]$  denotes the greatest integer less than or equal to  $x$ . If the function  $f(x) = \tan\left(\sqrt{[n]x}\right)$  has period  $\frac{\pi}{3}$ . then find the value of  $n$ .

- A.  $n \in (1, 3)$
- B.  $n \in (9, 10)$
- C.  $n \in [9, 10)$
- D.  $n \in [9, \infty)$

**Answer: C**



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74. Let  $f(x) = \sin \sqrt{[a]x}$  (where  $[ ]$  denotes the greatest integer function). If  $f$  is periodic with fundamental period  $\pi$ , then  $a$  belongs to

- A.  $\lambda \in [4, 5)$
- B.  $\lambda \in [4, 5]$
- C.  $\lambda = 4, 5$



D. none of these

**Answer: A**



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75. Which of the following functions is non-periodic? (1)  $\frac{2^x}{2^x} =$  (2)  $\sin^{-1}(\{x\})$  (3)  $\sin^{-1}(\sqrt{\cos x})$  (4)  $\sin^{-1}(\cos x^2)$

A.  $f(x) = \tan(3x+5)$

B.  $g(x) = \{x\}$ , the fractional part of  $x$

C.  $f(x) = 1 - \frac{\cos^2 x}{1 + \tan x} - \frac{\sin^2}{1 + \cot x}$

D.  $\phi(x) = x + \cos x$

**Answer: D**



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76. The period of the function

$$f(x) = \cos 2\pi\{2x\} + \sin 2\pi\{2x\},$$

is ( where  $\{x\}$  denotes the fractional part of  $x$ )

A. 1

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

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

D.  $\pi$

**Answer: C**



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77. The period of

$$f(x) = \frac{1}{2} \left\{ \frac{|\sin x|}{\cos x} + \frac{|\cos x|}{\sin x} \right\}, \text{ is}$$

A.  $2\pi$

B.  $\pi$

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

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

**Answer: A**



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78. The function  $f(x) = 2 \cos 5x + 3 \sin \sqrt{5x}$ , is

A. a periodic function with period  $2\pi$

B. a periodic function with period  $\frac{2\pi}{5}$

C. a periodic function with period  $\frac{2\pi}{\sqrt{5}}$

D. not a periodic function

**Answer: D**



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79. If  $f(x) = \lambda|\sin x| + \lambda^2|\cos x| + g(\lambda)$  has a period  $= \frac{\pi}{2}$  then find the value of  $\lambda$

A. 1

B. 2

C. 3

D. none of these

**Answer: A**



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80. The period of the function

$$f(x) = \sin\left(\frac{\pi x}{n!}\right) + \cos\left(\frac{\pi x}{(n+1)!}\right), \text{ is}$$

A.  $2 \times (n+1)!$

B.  $2(n!)!$

C.  $n+1$

D. none of these

**Answer: A**



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**81.** The function  $f(x) = \cos \frac{x}{2} + \{x\}$ , where  $\{x\}$  = the fractional part of  $x$ , is a

- A. periodic function with period  $4\pi$
- B. periodic function with period 1
- C. periodic function with indeterminate period
- D. none of these

**Answer: D**



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82. The function  $f(x) = \min \{x - [x], -x - | -x |\}$  is a

- A. periodic function with period 1
- B. periodic function with period  $1/2$
- C. non-periodic function
- D. periodic function with period 2

**Answer: A**



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83. If  $[x]$  denotes the greatest integer less than or equal to  $x$  and  $n \in N$ , then  $f(x) = nx + n - [nx + n] + \tan \frac{\pi x}{2}$ , is

- A. a periodic function with period 1
- B. a periodic function with period 4 .
- C. not periodic
- D. a periodic function with period 2.

**Answer: D**



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84. Let  $f(x) = \frac{\sin 2nx}{1 + \cos^2 nx}$ ,  $n \in N$  has  $\frac{\pi}{6}$  as its fundamental period ,  
then n=

A. 2

B. 4

C. 6

D. none of these

**Answer: C**



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85. Which of the following functions is an odd functions ?

A.  $f(x) = \sqrt{1 + x + x^2} - \sqrt{1 - x + x^2}$

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

C.  $f(x) = \log_{10} \left( \frac{1 - x^2}{1 + x^2} \right)$

D.  $f(x) = k$  (constant)

**Answer: A**

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**86.** Which of the following functions is an odd functions ?

A.  $f(x) = \text{const}$

B.  $f(x) = \sin x + \cos x$

C.  $f(x) = \sin \left\{ \log_{10} \left( x + \sqrt{x^2 + 1} \right) \right\}$

D.  $f(x) = 1 + x + 2x^2$

**Answer: C**

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87. If  $f$  is an even function defined on the interval  $(-5, 5)$  then find the total number of real values of  $x$  satisfying the equations

$$f(x) = f\left(\frac{x+1}{x+2}\right) \text{ are}$$

A. 1

B. 2

C. 4

D. none of these

**Answer: C**



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88. The function  $f(x)$  given by

$$f(x) = \begin{cases} x^4 \tan \frac{\pi x}{2} & |x| < 1 \\ x|x| & |x| \geq 1 \end{cases} \text{ is}$$

A. an odd function

B. an even function

C. a periodic function with period  $\frac{2\pi}{\sqrt{5}}$

D. none of these

**Answer: A**



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89. If a real valued function  $f(x)$  satisfies the equation  $f(x + y) = f(x) + f(y)$  for all  $x, y \in R$  then  $f(x)$  is

A. a periodic function

B. an even function

C. an odd function

D. none of these

**Answer: C**



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90. A function whose graph is symmetrical in opposite quadrants is

A.  $f(x) = e^x + e^{-x}$

B.  $f(x) = \log_e x$

C.  $f(x + y) = f(x) + f(y)$

D.  $f(x) = \cos(x) + \sin x$

**Answer: C**



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91. A function whose graph is symmetrical about y-axis is

A.  $f(x) = x \left( \frac{3^x - 1}{3^x - 1} \right)$

B.  $f(x) = \log_2 \left( x + \sqrt{x^2 + 1} \right)$

C.  $f(x + y) = f(x) + f(y)$

D.  $f(x) = \sin x + \cos x$

**Answer: A**



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**92.** A function  $f(x)$  given by

$$f(x) = \begin{cases} x^2 \sin \frac{\pi x}{2} & |x| < 1 \\ x|x| & |x| \geq 1 \end{cases} \text{ is}$$

- A. an even function
- B. an odd function
- C. a periodic function
- D. none of these

**Answer: B**



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**93.** If  $f(x)$  is a real valued odd function , then which one of the following is incorrect ?

A.  $\frac{f(x) - f(-x)}{2}$  is an odd function.

B.  $\frac{f(x) + f(-x)}{2}$  is an even function.

C.  $[|f(x)| + 2]$  is an even function,  $[\cdot]$  denotes the greatest integer function.

D.  $\frac{f(x) - f(-x)}{2}$  is neither even nor odd.

**Answer: D**

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94. If  $f: [-\pi/2, \pi/2] \cup \mathbb{R}$  given by  $f(x) = \cos x + \sin \left[ \frac{x+1}{\lambda} \right]$  is an even function. Then the set of values of  $\lambda (\lambda > 0)$  is Here,  $[\cdot]$  denotes the greatest integer function.

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

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

C.  $\left( 0, \frac{\pi+2}{2} \right) \cup \left( \frac{\pi+2}{2}, \infty \right)$

D.  $\left(\frac{-\pi}{2}, \frac{\pi + 2}{2}\right) - \{0\}$

**Answer: B**



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95. If  $f(x)$  is an odd periodic function with period 2, then  $f(4)$  equals to-

A.  $-4$

B.  $4$

C.  $2$

D.  $0$

**Answer: D**



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96. Let  $f$  be a real function satisfying  $f(x) + f(y) = f\left(\frac{x+y}{1-xy}\right)$  for all  $x, y \in \mathbb{R}$  and  $xy \neq 1$ .

Then  $f(x)$  is

- A. a periodic function with period  $\pi/2$
- B. an odd function
- C. an even function
- D. none of these

**Answer: B**



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97. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  such that  $f(x+y) + f(x-y) = 2f(x)f(y)$  for all  $x, y \in \mathbb{R}$ . Then,

- A.  $f(x)$  an even function, if  $f(0) \neq 0$
- B.  $f(x)$  is an odd function, if  $f(0) \neq 0$

C.  $f(x)$  an even function , if  $f(0) = 0$

D.  $f(x)$  is an odd function , if  $f(0) = 0$

**Answer: A::D**



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98. Let  $f: \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \rightarrow \mathbb{R}$  be given by  $f(x) = (\log(\sec x + \tan x))^3$

Then which of the following is wrong?

A.  $f(x)$  is an odd function

B.  $f(x)$  is a one-one function

C.  $f(x)$  is an onto function

D.  $f(x)$  is an even function

**Answer: A::B::C**



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99.  $f(x) = \begin{cases} 4 & x < -1 \\ -4x & -1 \leq x \leq 0 \end{cases}$  If  $f(x)$  is an even function in  $\mathbb{R}$  then

the definition of  $f(x)$  in  $(0, \infty)$  is: (A)  $f(x) = \begin{cases} 4x & 0 < x \leq 1 \\ 4 & x > 1 \end{cases}$  (B)

$f(x) = \begin{cases} 4x & 0 < x \leq 1 \\ -4 & x > 1 \end{cases}$  (C)  $f(x) = \begin{cases} 4 & 0 < x \leq 1 \\ 4x & x > 1 \end{cases}$  (D)

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

A.  $f(x) = \begin{cases} 4x & 0 < x \leq 1 \\ 4 & x > 1 \end{cases}$

B.  $f(x) = \begin{cases} 4x & 0 < x \leq 1 \\ -4 & x > 1 \end{cases}$

C.  $f(x) = \begin{cases} 4 & 0 < x \leq 1 \\ 4x & x > 1 \end{cases}$

D. none of these

**Answer: A**

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100. Let the function

$f(x) = 4 \sin x + 3 \cos x + \log(|x| + \sqrt{1 + x^2})$  be defined on the interval  $[0, 1]$ . The odd extension of  $f(x)$  to the interval  $[-1, 1]$  is

A.  $4 \sin x + 3 \cos x + \log(|x| + \sqrt{1 + x^2}), -1 \leq x < 0$

B.  $4 \sin x - 3 \cos x - \log(|x| + \sqrt{1 + x^2}), -1 \leq x < 0$

C.  $4 \sin x + 3 \cos x + \log(|x| + \sqrt{1 + x^2}), -1 \leq x < 0$

D. none of these

**Answer: B**



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## Section I - Solved Mcqs

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

A.  $\frac{f(x) + \alpha}{1 + \alpha f(x)}$

B.  $\frac{(\alpha - 1)f(x) + \alpha + 1}{(\alpha + 1)f(x) + (\alpha - 1)}$

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

D. none of these

**Answer: c**



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

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

B.  $f(\alpha) = 10$

C.  $f(\beta) = -10$

D. none of these

**Answer: A**



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3. Let  $f: R \rightarrow R$  be a function given by  $f(x + y) = f(x) + f(y)$  for all  $x, y \in R$  such that  $f(1) = a$  Then,  $f(x) =$

A.  $a^x$

B.  $ax$

C.  $a^x$

D.  $a + x$

**Answer: B**



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4. Let  $f: R \rightarrow R$  be a function given by  $f(x + y) = f(x) + f(y)$  for all  $x, y \in R$  such that  $f(1) = a$  Then,  $f(x) =$

A.  $a^x$

B.  $ax$

C.  $a^x$

D. none of these

**Answer: A**

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5. Let  $f$  be a real valued function satisfying  $f(x + 1) + f(x - 1) = 2f(x)$  for all  $x, y \in R$  and  $f(0) = 0$ , then for any  $n \in N$ ,  $f(n) =$

A.  $n f(1)$

B.  $[f(1)]^n$

C. 0

D. none of these

**Answer: A**

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6. If  $f(x)$  is a real valued function satisfying  $f(x + y) = f(x) + f(y) - xy - 1$  for all  $x, y \in R$  such that  $f(1) = 1$  then the number of solutions of  $f(n) = n, n \in N$ , is

A. 1

B. 2

C. 3

D. 4

**Answer: A**



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7. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  satisfies  $f(x+y)=f(x)+f(y)$  for all  $x, y \in \mathbb{R}$  and  $f(1)=7$ , then

$\sum_{r=1}^n f(r)$ , is

A.  $3^m - 1$

B.  $3^m$

C.  $3^{m-1}$

D. none of these

**Answer: C**



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8. If  $f(x) = ax^2 + bx + c$  satisfies the identity

$$f(x + 1) - f(x) = 8x + 3 \text{ for all } x \in R \text{ Then } (a,b)=$$

A. (2, 1)

B. (4, - 1)

C. ( - 1, 4)

D. ( - 1, 1)

**Answer: B**



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9. If  $f(x + y, x - y) = xy$  then  $\frac{f(x, y) + f(y, x)}{2} =$

A. x

B. y

C. 0

D. none of these

**Answer: C**



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10. A polynomial function  $f(x)$  satisfies the condition

$$f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right) \text{ for all } x \in \mathbb{R}, x \neq 0. \text{ If } f(3)=-26, \text{ then } f(4)=$$

A.  $-35$

B.  $-63$

C. 65

D. none of these

**Answer: B**



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11. If  $f: R \rightarrow R, g: R \rightarrow R$  be two functions, and  $h(x) = 2\min\{f(x) - g(x), 0\}$  then  $h(x) =$

- 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: D**



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12. If  $f(x) = \cos[\pi]x + \cos[\pi x]$ , where  $[y]$  is the greatest integer function of  $y$  then  $f\left(\frac{\pi}{2}\right)$  is equal to

- A.  $\cos 3$
- B. 0
- C.  $\cos 4$

D. none of these

**Answer: C**

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13. If  $f(x) = \cos\left[\frac{\pi^2}{2}\right]x + \sin\left[\frac{-\pi^2}{2}\right]x$ ,  $[x]$  denoting the greatest integer function, then

A.  $f(0) = 0$

B.  $f\left(\frac{\pi}{3}\right) = \frac{\sqrt{(3) - 1}}{2}$

C.  $f\left(\frac{\pi}{2}\right) = -1$

D.  $f(\pi) = 0$

**Answer: B**

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14. If one the roots fo the equation  $x^2 + xf(a) + a = 0$  is the cube of the other for all  $x \in R$ , then  $f(x)=$

A.  $x^{1/4} + x^{3/4}$

B.  $-(x^{1/4} + x^{3/4})$

C.  $x + x^3$

D. none of these

**Answer: B**



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15. If the graph of a function  $f(x)$  is symmetrical about the line  $x = a$ , then

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

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

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

D. none of these

**Answer: A**



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16. If a real function  $f(x)$  satisfies the relation  $f(x) = f(2a - x)$  for all  $x \in R$ . Then, its graph is symmetrical about the line.

A.  $x = 0$

B.  $x = 2a$

C.  $x = a$

D.  $x = -a$

**Answer: B**



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17. The largest interval lying in  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$  for which the function  $\left[f(x) = 4^{-x} \wedge 2 + \cos^{-1}\left(\frac{x}{2} - 1\right) + \log(\cos x)\right]$  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.  $[-\pi/4, 2)$

B.  $[0, \pi/2)$

C.  $[0, \pi]$

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

**Answer: B**



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**18.** The domain of  $f(x) = \log_2(2x^3 - x^2 - 4x + 2)$ , is

A.  $(-\sqrt{2}, 1/2) \cup (\sqrt{2}, \infty)$

B.  $(-1, 1/2) \cup (\sqrt{2}, \infty)$

C.  $(-\sqrt{2}, -1) \cup (1, \infty)$

D.  $(-\infty, -\sqrt{2}) \cup (\sqrt{2}, \infty)$

**Answer: A**



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19. If  $f(x) = 1 - x$ ,  $x \in [-3, 3]$ , then the domain of  $f \circ f(x)$  is

A.  $[-3, 3]$

B.  $[-2, 3]$

C.  $(-2, 3)$

D.  $[-2, 3)$

Answer: B



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20. If  $f(x) = \sqrt{2-x}$  and  $g(x) = \sqrt{1-2x}$ , then the domain of  $f \circ g(x)$  is

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

B.  $[1/2, \infty)$

C.  $(-\infty, -3/2]$

D. none of these

**Answer: C**



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21. Let  $f \circ g(x) = \log_e x$  and  $g(x) = \frac{x^4 - 2x^3 + 3x^2 - 2x + 2}{2x^2 - 2x + 1}$

Then , the domain of fog (x) is

A.  $R$

B.  $[0, \infty)$

C.  $(0, \infty)$

D.  $[1, \infty)$

**Answer: A**



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22. Let  $f(x)$  be a function whose domain is  $[-5, 7]$  and  $g(x) = |2x + 5|$ .

Then, the domain of  $f \circ g(x)$  is .

A.  $[-5, 1]$

B.  $[-4, 0]$

C.  $[-6, 1]$

D. none of these

**Answer: C**



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23. The domain of  $f(x) = \frac{\log_2(x + 3)}{x^2 + 3x + 2}$ , is

A.  $R - \{-1, -2\}$

B.  $(-2, \infty)$

C.  $R - \{-1, -2, -3\}$



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

**Answer: D**



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24. The domain of definition of  $f(x) = \sin^{-1}\{\log_2(x^2 + 3x + 4)\}$ , is

A.  $[-4, -1/4]$

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

C.  $[-2, -1]$

D. none of these

**Answer: C**



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25. The domain of definition of  $f(x) = \sin^{-1}[2 - 4x^2]$  is ( $[.]$  denotes the greatest integer function).

- A.  $[\sqrt{3}/2, \sqrt{3}/2]$
- B.  $[-\sqrt{3}/2, 0]$
- C.  $[-\sqrt{3}/2, 0) \cup (0, \sqrt{3}/2]$
- D.  $[-\sqrt{3}/2, \infty)$

**Answer: C**



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26. The domain of the function  $f(x) = \sqrt{x^2 - [x]^2}$ , where  $[x]$  is the greatest integer less than or equal to  $x$ , is  $R$  (b)  $[0, +\infty)$  (c)  $(-\infty, 0)$  (d) none of these

- A.  $R$
- B.  $[0, \infty)$

C.  $(-\infty, 0]$

D. none of these

**Answer: D**



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27. The domain of definition of  $f(x) = \cos^{-1}(x + [x])$  is

A.  $[0, 1)$

B.  $R - Z$

C.  $(0, \infty)$

D. none of these

**Answer: A**



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28. The domain of definition of the functions  $f(x - [x])$ , is

A.  $R$

B.  $R - Z$

C.  $(0, \infty)$

D. none of these

**Answer: B**



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29. If  $f(x) = [x]$  and  $g(x) = \{x\}$  = fraction part of  $x$ , then for any two real numbers  $x$  and  $y$ .

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

B.  $g(x + y) = g(x) + g(y)$

C.  $f(x + y) = f(x) + f(y + g(x))$

D. none of these

**Answer: C**



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**30.** The domain of definition of  $f(x) = \log_2(\log_3(\log_4 x))$ , is

A.  $[4, \infty)$

B.  $(4, \infty)$

C.  $(-\infty, 4)$

D. none of these

**Answer: B**



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**31.** The domain of the function  $f(x) = \log_2[\log_3(\log_4(x^2 - 3x + 6))]$  is

A.  $(1, 2)$

B.  $[1, 2]$

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

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

**Answer: C**



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32. The domain of definition of the function  $f(x) = \sqrt{\log_{10}\left(\frac{2-x}{x}\right)}$  is

A.  $(0, 1)$

B.  $[0, 1]$

C.  $(0, 1]$

D.  $(0, 2)$

**Answer: C**



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33. The domain of definition of the function  $f(x) = \sqrt{\log_{x^2-1} x}$  is

A.  $(\sqrt{2}, \infty)$

B.  $(0, \infty)$

C.  $(1, \infty)$

D. none of these

**Answer: A**



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34. Find the domain of the following functions :

$$f(x) = \sqrt{\log_{10} \left( \frac{\log_{10} x}{2(3 - \log_{10} x)} \right)}$$

A.  $(10^2, 10^3)$

B.  $[10^2, 10^3]$

C.  $[10^2, 10^3)$

D.  $(10, 10^3)$

**Answer: A**



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35. The domain of definition of the function

$$f(x) = \log_3 \left\{ -\log_{1/2} \left( 1 + \frac{1}{x^{1/5}} \right) - 1 \right\}$$

A.  $(-\infty, 1)$

B.  $(0, 1)$

C.  $(1, \infty)$

D. none of these

**Answer: B**



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36. If  $[x]$  denote the greater integer less than or equal to  $x$ , then the domain of definition of the real valued function

$$f(x) = \log_{[x+1/2]} |x^2 - x - 2|, \text{ is}$$

- A.  $[3/2, \infty)$
- B.  $[3/2, 2) \cup (2, \infty)$
- C.  $(1/2, 2) \cup (2, \infty)$
- D. none of these

**Answer: B**



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37. If  $e^x + e^{f(x)} = e$  then domain of  $f(x)$  is

- A.  $(-\infty, 1)$
- B.  $(-\infty, 0)$
- C.  $(1, \infty)$

D. none of these

**Answer: A**



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**38.** 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.  $(-1, e)$

B.  $(1, e)$

C.  $(e, 1)$

D.  $(-e, 1)$

**Answer: C**



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39. The domain of definition of  $f(x) = \sqrt{e^{(\cos^{-1}(\log_4 x^2))}}$  is

A.  $[1/2, 2]$

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

C.  $[-2, -1/2]$

D. none of these

**Answer: B**



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40. The domain of definition of function  $f(x) = 4\sqrt{\log_3 \left\{ \frac{1}{|\cos x|} \right\}}$  is

A.  $R$

B.  $R - \{n\pi : n \in Z\}$

C.  $R - \left\{ (2n + 1) \frac{\pi}{2} : n \in Z \right\}$

D. none of these

**Answer: C**

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41. The domain of definition of  $f(x) = \sqrt{\sec^{-1}\left\{\frac{1-|x|}{2}\right\}}$  is

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

B.  $[3, \infty)$

C.  $\phi$

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

**Answer: D**

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42. The domain of the function  $f(x) = \sqrt{\cos^{-1}\left(\frac{1-|x|}{2}\right)}$  is

A.  $[-3, 3]$

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

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

D. 1

**Answer: A**



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43. The domain of definition of the function

$$f(x) = \cot^{-1} \left\{ \frac{x}{\sqrt{x^2 - [x^2]}} \right\} \text{ is}$$

A.  $R - \{ \pm \sqrt{n} : n \in N \}$

B.  $R - \{ \pm \sqrt{n} : n \geq 0, \neq Z \}$

C.  $R$

D.  $R - \{0\}$

**Answer: B**



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44. The function  $f(x) = \cot^{-1} \sqrt{x(x+3)} + \cos^{-1} \sqrt{x^2 + 3x + 1}$  is defined on the set S, where S is equal to

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

B.  $[-3, 0]$

C.  $[0, 3]$

D.  $\phi$

**Answer: A**

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45. The domain of the definition of the function of the function  $y(x)$  given by the equation  $2^x + 2^y = 2$  is

A.  $0 < x \leq 1$

B.  $0 \leq x \leq 1$

C.  $-\infty < x \leq 0$

D.  $-\infty < x < 1$

**Answer: D**



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46. 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.  $[-1, 2]$

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

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

D. none of these

**Answer: D**



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47. The domain of definition of the function

$$f(x) = \sqrt{3 - 2^x - 2^{1-x}} + \sqrt{\sqrt{\sin^{-1} x}}, \text{ is}$$

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

**Answer: A**



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48. The domain of definition of  $f(x) = \log_x \cos x$ , is

- A.  $(-\pi/2, \pi/2) - \{1\}$
- B.  $[-\pi/2, \pi/2] - \{1\}$
- C.  $(-\pi/2, \pi/2)$



D. none of these

**Answer: D**



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49. The domain of the function

$$f(x) = \sin^{-1}\left(\frac{2 - |x|}{4}\right) + \cos^{-1}\left(\frac{2 - |x|}{4}\right) + \tan^{-1}\left(\frac{2 - |x|}{4}\right) \text{ is}$$

A.  $[0, 3]$

B.  $[-6, 6]$

C.  $[-1, 1]$

D.  $[-3, 3]$

**Answer: B**



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50. The set of all real values of  $x$  for which the function

$f(x) = \sqrt{\sin x + \cos x} + \sqrt{7x - x^2 - 6}$  takes real values is

- A.  $[1, 3\pi/4] \cup [7\pi/4, 6]$
- B.  $[1, 3\pi/4] \cup [6 - \pi/4, 6]$
- C.  $[1, 6]$
- D. none of these

**Answer: A**



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51. If  $f(x)$  is defined on  $(0, 1]$ , then the domain of  $f(\sin x)$  is

- A.  $(2n\pi, (2n + 1)\pi), n \in \mathbb{Z}$
- B.  $\left( (2n + 1)\frac{\pi}{2}, (2n + 3)\frac{\pi}{2} \right), n \in \mathbb{Z}$
- C.  $((n - 1)\pi, (n + 1)\pi), n \in \mathbb{Z}$
- D. none of these

**Answer: A**



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52. Let  $f(x) = \cos^{-1}\left(\frac{x^2}{x^2 + 1}\right)$ . Then , the range of the f , is

A.  $(0, \pi/2]$

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

C.  $[-\pi/2, 0]$

D. none of these

**Answer: A**



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53. The range of the function  $f(x) = \frac{1}{2 - \sin 3x}$  is

A.  $(1/3, 1)$

B.  $[1/3, 1)$

C.  $[1/3, 1]$

D. none of these

**Answer: C**



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**54.** The range of the function  $f(x) = \log_3(5 + 4x - x^2)$ , is

A.  $(0, 2]$

B.  $(-\infty, 2]$

C.  $(0, 9]$

D. none of these

**Answer: B**



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55. The range of the function is  $f(x) = \log_5(25 - x^2)$  is

- A.  $[0, 5]$
- B.  $[0, 2)$
- C.  $(0, 2)$
- D. none of these

**Answer: D**



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56. The range of the functions  $f: [0, 1] \rightarrow R$ , given by

$$f(x) = x^3 - x^2 + 4x + 2 \sin^{-1} x, \text{ is}$$

- A.  $[-\pi - 2, 0]$
- B.  $[2, 3]$
- C.  $[0, 4 + \pi]$
- D.  $[0, 2 + \pi]$

**Answer: C**



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57. Let  $f(x) = 4 \cos \sqrt{x^2 - \frac{\pi^2}{9}}$  Then the range of  $f(x)$  is

A.  $[-1, 1]$

B.  $[-4, 4]$

C.  $[0, 1]$

D. none of these

**Answer: B**



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58. The range [परिसर] of the function  $f(x) = \tan \sqrt{\frac{\pi^2}{9} - x^2}$ , is

A.  $[0, \sqrt{3}]$

B.  $(0, \sqrt{3})$

C.  $[0, \sqrt{3})$

D.  $(0, \sqrt{3}]$

**Answer: A**



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59. Let  $f(x) = \sec^{-1}[1 + \cos^2 x]$ , where  $\lfloor x \rfloor$  denotes the greatest integer function. Then the range of  $f(x)$  is

A.  $[1, 2]$

B.  $[0, 2]$

C.  $\{\sec^{-1} 1, \sec^{-1} 2\}$

D. none of these

**Answer: C**



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60. The range of the function  $f(x) = \sqrt{2-x} + \sqrt{1+x}$

A.  $[\sqrt{3}, \sqrt{6}]$

B.  $[0, \sqrt{6}]$

C.  $(\sqrt{3}, \sqrt{6})$

D. none of these

**Answer: A**



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61. The range of the function  $f$  defined by  $f(x) = \left[ \frac{1}{\sin\{x\}} \right]$  (where  $[.]$

and  $\{.\}$ , respectively, denote the greatest integer and the fractional part

functions) is I, the set of integers N, the set of natural number W, the set

of whole numbers  $\{1,2,3,4,\dots\}$

A.  $Z$



B.  $N$

C.  $\{x : x \geq 0, x \in Z\}$

D.  $\{x : x \geq 2, x \in N\}$

**Answer: B**



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62. If  $f(x)$  is a periodic function with period  $\lambda$  then  $f(\lambda x + u)$  where  $u$  is any constant is periodic with period  $\frac{\lambda}{a}$ .

A.  $\lambda$

B. 1

C.  $\frac{\lambda}{a}$

D. none of these

**Answer: C**



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63. The period of the function  $f(x) = \left| \cos. \frac{x}{2} \right| + |\sin x|$  is

A.  $2\pi$

B.  $\pi$

C.  $4\pi$

D. none of these

**Answer: A**



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64. Let  $f(x) = x(2 - x)$ ,  $0 \leq x \leq 2$ . If the definition of  $f(x)$  is extended over the set  $R - [0, 2]$  by  $f(x + 1) = f(x)$ , then f is a

A. periodic function with period 1

B. non-periodic function

C. periodic function with period 2

D. periodic function with period  $1/2$

**Answer: C**



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65. The period of the function  $f(x) = \frac{|\sin x| - |\cos x|}{|\sin x + \cos x|}$  is

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

B.  $2\pi$

C.  $\pi$

D. none of these

**Answer: C**



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66. The function  $f(x) = 3^{\sin^2 \pi + \sin^4 \pi x + x - [x]}$  where  $[x]$  denotes the greatest interger less than or equal to  $x$ , is

- A. a periodic function with period 1
- B. a periodic function with period 2
- C. a periodic function with period  $\frac{1}{2}$
- D. not a periodic function

**Answer: A**



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67. Period of the function  $f(x) = \frac{1}{3} \{ \sin 3x + |\sin 3x| + [\sin 3x] \}$  is (where  $[.]$  denotes the greatest integer function )

- A.  $\frac{\pi}{3}$
- B.  $\frac{2\pi}{3}$
- C.  $\frac{4\pi}{3}$

D.  $\pi$

**Answer: B**



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68. The function  $f(\theta) = \cos(\pi \sin^3 \theta)$ , is

A. not periodic

B. periodic and its period is same as that of  $\cos \theta$

C. periodic and its period is same as that of  $\cos 2\theta$

D. periodic and its period is same as that of  $\cos(\pi\theta)$

**Answer: C**



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69. Let  $f(x) = \frac{1}{\sqrt{|x-1| - [x]}}$  where  $[.]$  denotes the greatest integer

function then the domain of  $f(x)$  is

- A.  $(-1, 1)$
- B.  $(-\infty, 1)$
- C.  $(-\infty, -1)$
- D. none of these

**Answer: B**



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70. Let  $f(x) = [9^x - 3^x + 1]$  for all  $x \in (-\infty, 1)$ , then the range of  $f(x)$  is, ( $[.]$  denotes the greatest integer function).

- A.  $\{0, 1, 2, 3, 4, 5, 6, 7\}$
- B.  $\{0, 1, 2, 3, 4, 5, 6\}$
- C.  $\{1, 2, 3, 4, 5, 6, 7\}$

D.  $\{1, 2, 3, 4, 5, 6\}$

**Answer: D**



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71. If  $f(x) = \log_{e^2x} \left( \frac{2 \ln x + 2}{-x} \right)$  and  $g(x) = \{x\}$  then range of  $g(x)$  for existence of  $f(g(x))$  is

A.  $(0, 2/e)$

B.  $(0, 1/e) - \{1/e^2\}$

C.  $(0, 3/e)$

D. none of these

**Answer: B**



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72. The domain and range of  $f(x) = \cos^{-1} \sqrt{\log_{[x]} \left( \frac{|x|}{x} \right)}$  where  $[.]$  denote the greatest integer function are respectively

- A.  $[1, \infty), [0, \pi/2]$
- B.  $[2, \infty), [0, \pi/2)$
- C.  $[2, \infty), \{\pi/2\}$
- D.  $[1, \infty), \{0\}$

**Answer: C**



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73. period the function  $f(x) = \frac{\sin\{\sin(nx)\}}{\tan\left(\frac{x}{n}\right)}$ ,  $n \in \mathbb{N}$ , is  $6\pi$  then  $n =$  -----

--

- A. 3
- B. 2



C. 1

D. none of these

**Answer: A**



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74. If  $[.]$  and  $\{.\}$  denote greatest integer and fractional part functions respectively, then the period of  $f(x) = e^{\sin 3\pi\{x\} + \tan \pi[x]}$  is

A.  $2/3$

B. 1

C. 3

D. none of these

**Answer: B**



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75. The domain of the function  $f(x)$  given by

$$3^x + 3^f = \min(2t^3 - 15t^2 + 36 + -25, 2 + |\sin t|, 2 \leq t \leq 4)$$

A.  $(-\infty, 1)$

B.  $(-\infty, \log_3 e)$

C.  $(0, \log_3 2)$

D.  $(-\infty, \log_3 2)$

**Answer: D**



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76. Let  $f: (4, 6) \rightarrow (6, 8)$  be a function defined by  $f(x) = x + \left[ \frac{x}{2} \right]$

where  $[.]$  denotes the greatest integer function, then  $f^{-1}(x)$  is equal to

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

B.  $-x - 2$

C.  $x - 2$

$$D. \frac{1}{x + \left[\frac{x}{2}\right]}$$

**Answer: C**

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77. The domain of definition of the function  $f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$  for real-valued  $x$  is  $\left[-\frac{1}{4}, \frac{1}{2}\right]$  (b)  $\left[-\frac{1}{2}, \frac{1}{2}\right]$  (c)  $\left(-\frac{1}{2}, \frac{1}{9}\right)$  (d)  $\left[-\frac{1}{4}, \frac{1}{4}\right]$

A.  $[-1/4, 1/2]$

B.  $[-1/2, 1/2]$

C.  $[-1/2, 1/9]$

D.  $[-1/4, 1/4]$

**Answer: A**

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78. The range of the function  $f(x) = \frac{x^2 + x + 2}{x^2 + x + 1}$ ,  $x \in R$ , is

- A.  $(1, \infty)$
- B.  $(1, 11/7]$
- C.  $[1, 7/3]$
- D.  $(1, 7/5]$

**Answer: C**



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79. If  $f(x) = \sin x + \cos x$  and  $g(x) = x^2 - 1$ , then  $g(f(x))$  is invertible in the domain .

- A.  $[0, \pi/2]$
- B.  $[-\pi/4, \pi/4]$
- C.  $[-\pi/4, \pi/2]$
- D.  $[0, \pi]$

**Answer: B**



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

A.  $[-1, 3]$

B.  $[-1, 1]$

C.  $[0, 1]$

D.  $[0, 3]$

**Answer: A**



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

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

**Answer: B**

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82. The domain of the function  $f(x) = \sin^{-1}\left(\frac{8(3)^{x-2}}{1-3^{2(x-1)}}\right)$  is

A.  $(-\infty, 0]$

B.  $[2, \infty)$

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

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

**Answer: C**

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83. find the value of the

A.  $\pm \sqrt{n\pi}, n \in \{0, 1, 2, \dots\}$

B.  $\pm \sqrt{n\pi}, n \in \{1, 2, \dots\}$

C.  $\frac{\pi}{2} + 2n\pi, n \in \{\dots, -2, -1, 0, 1, 2, \dots\}$

D.  $2n\pi, n \in \{\dots -2, -1, 0, 1, 2, \dots\}$

**Answer: A**



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84. Consider the statements : P : There exists some  $x \in \mathbb{R}$  such that  $f(x) + 2x = 2(1+x^2)$  Q : There exists some  $x \in \mathbb{R}$  such that  $2f(x) + 1 = 2x(1+x)$  Then (A) both P and Q are true (B) P is true and Q is false (C) P is false and Q is true (D) both P and Q are false.

A. both P and Q are true

B. P is true and Q is false

C. P is false and Q is true

D. both P and Q are false

**Answer: C**



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85. Let  $f(x) = \sin\left[\frac{\pi}{6}\sin\left(\frac{\pi}{2}\sin x\right)\right]$  for all  $x \in \mathbb{R}$

A. Range of f is  $\left[-\frac{1}{2}, \frac{1}{2}\right]$

B. Range of fog is  $\left[-\frac{1}{2}, \frac{1}{2}\right]$

C.  $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)} = \frac{\pi}{6}$

D. There is an  $x \in \mathbb{R}$  such that  $(gof)(x) = 1$

**Answer: A::B::C**



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86. Consider the function  $f$  defined on the set of all non-negative integers such that  $f(0) = 1, f(1) = 0$  and  $f(n) + f(n - 1) = nf(n - 1) + (n - 1)f(n - 2)$  for  $n \geq 2$ , then  $f(5)$  is equal to

A. 40

B. 44

C. 45

D. 60

**Answer: B**



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87. In a function

$$2f(x) + xf\left(\frac{1}{x}\right) - 2f\left(\left|\sqrt{2}\sin\left(\pi\left(x + \frac{1}{4}\right)\right)\right|\right) = 4\cos^2\left[\frac{\pi x}{2}\right] + x\cos\left(\frac{\pi}{x}\right)$$

. Prove that: 1.  $f(2)+f(1/2)=1$  2.  $f(2)+f(1)=0$

A.  $f(2) + f\left(\frac{1}{2}\right) = 0$

B.  $f(1) = -1$  but  $f(2)$ ,  $f\left(\frac{1}{2}\right)$  cannot be determined

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

D.  $f(2) + f(1) = 1$

**Answer: C**



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**88.** Let  $X$  be the set of all positive such that  $f(x + y) = f(xy)$  for all  $x \geq 4, y \geq 4$ . If  $f(8) = 9$ , then  $f(9)$  is equal to.

A. 8

B. 9

C. 81

D. 64

**Answer: B**



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89.  $f(x) = \frac{9^x}{1 + 9^x}$  then value of  $f\left(\frac{1}{2015}\right) + f\left(\frac{2}{2015}\right) + \dots + f\left(\frac{4029}{2015}\right)$

A. 1007

B.  $\frac{4029}{2}$

C. 2014

D. 2015

Answer: D



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90. Range of the function

$f(x) = \sqrt{\cos^{-1}\left(\sqrt{\log_4 x}\right) - \frac{\pi}{2}} + \sin^{-1}\left(\frac{1+x^2}{4x}\right)$  is equal to (A)  $\left(0, \frac{\pi}{2} + \sqrt{\frac{\pi}{2}}\right)$  (B)  $\left[\frac{\pi}{2}, \frac{\pi}{2} + \sqrt{\frac{\pi}{2}}\right]$  (C)  $\left[\frac{\pi}{6}, \frac{\pi}{4}\right)$  (D)  $\left\{\frac{\pi}{6}\right\}$

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

B.  $\left[\frac{\pi}{2}, \frac{\pi}{2} + \sqrt{\frac{\pi}{2}}\right]$

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

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

**Answer: D**



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**91.** Consider the function  $g(x)$  defined as

$$g(x)(x^{2011-1} - 1) = (x + 1)(x^2 + 1)(x^4 + 1)\dots(x^{2^{2010}} + 1) - 1.$$
 Then

the value of  $g(2)$  is equal to

A. 1

B.  $2^{2020} - 1$

C.  $2^{2020}$

D. 2

**Answer: B**



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92. Let  $f(n) = 1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$ . Then  $f(1) + f(2) + f(3) + \dots + f(n)$  is equal to  $nf(n) - 1$  (b)  $(n + 1)f(n) - n$  (c)  $(n + 1)f(n) + n$  (d)  $nf(n) + n$

A.  $nf(n) - 1$

B.  $(n + 1)f(n) - n$

C.  $(n + 1)f(n) + n$

D.  $nf(n) + n$

**Answer: B**



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93. The period of the function

$$f(x) = 4 \sin^4\left(\frac{4x - 3\pi}{6\pi^2}\right) + 2 \cos\left(\frac{4x - 3\pi}{3\pi^2}\right) \text{ is}$$

A.  $\frac{3\pi^2}{4}$

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

C.  $\frac{4\pi^2}{3}$

D.  $\frac{4\pi^3}{3}$

**Answer: B**



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94. If  $f(x) = \frac{\log_{[x-1]}(|x|)}{x}$ , where  $[ \cdot ]$  denotes the greatest integer function, then

A.  $D(f) = [3, \infty)$ ,  $R(f) = \{0, 1\}$

B.  $D(f) = [3, \infty)$ ,  $R(f) = [3, \infty)$ ,  $R(f) = \{0\}$

C.  $D(f) = (2, \infty)$ ,  $R(f) = \{0, 1\}$

$$D. D(f) = (3, \infty), R(f) = \{0\}$$

**Answer: B**



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95. Domain (D) and range (R) of  $f(x) = \sin^{-1}(\cos^{-1}[x])$ , where  $[.]$  denotes the greatest integer function, is  $D \equiv x \in [1, 2], R \in \{0\}$

$$\equiv x \in [0, 1], R \equiv \{-1, 0, 1\}$$

$$\equiv x \in [-1, 1], R \equiv \left\{0, \sin^{-1}\left(\frac{\pi}{2}\right), \sin^{-1}(\pi)\right\}$$

$$\equiv x \in [-1, 1], R \equiv \left\{-\frac{\pi}{2}, 0, \frac{\pi}{2}\right\}$$

A.  $[1, 2)$  and  $\{0\}$

B.  $[0, 1]$  and  $\{-1, 0, 1\}$

C.  $[-1, 1]$  and  $\left\{0, \sin^{-1}\left(\frac{\pi}{2}\right), \sin^{-1}(\pi)\right\}$

D.  $[-1, 1]$  and  $\left\{-\frac{\pi}{2}, 0, \frac{\pi}{2}\right\}$

**Answer: A**



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## Section II - Assertion Reason Type

1. Statement-1: The period of  $\sin x$ ,  $\cos x$  is  $2\pi$  and period of  $f(x)+g(x)$  is the LCM of the periods of  $f(x)$  and  $g(x)$

- A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .
- B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False , Statement-2 is True.

**Answer: A**



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2. Statement-1: The period of the function  $f(x) = \cos[2\pi^2x] + \cos[-2\pi^2x] + [x]$  is  $\pi$ ,  $[x]$  being greatest integer function and  $\{x\}$  is a fractional part of  $x$ , is  $\pi$ .

Statement-2: The cosine function is periodic with period  $2\pi$

- A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1.
- B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1.
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

**Answer: D**



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3. Statement-1: The domain of definition of the function  $f(x) = e^{2x} + \cos^{-1}\left(\frac{x}{2} - 1\right)$ , is  $(0, 1) \cup (1, 2) \cup (2, 3) \cup (3, 4)$

Statement-2: The domain of  $\cos^{-1}\left(\frac{x}{2} - 1\right)$  is  $[0, 4]$ .

A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1.

B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

**Answer: D**



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4. Statement -1: Let  $f(x)$  be a function satisfying  $f(x - 1) + f(x + 1) = \sqrt{2}f(x)$  for all  $x \in R$ . Then  $f(x)$  is periodic with

period 8. Statement-2: For every natural number  $n$  there exists a periodic functions with period  $n$ .

- A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .
- B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False , Statement-2 is True.

**Answer: B**

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5. The period of

$$f(x) = \frac{1}{2} \left\{ \frac{|\sin x|}{\cos x} + \frac{|\cos x|}{\sin x} \right\}, \text{ is}$$

A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .

B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False , Statement-2 is True.

**Answer: B**



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6. Statement-1: Every function can be uniquely expressed as the sum of an even function and an odd function.

Statement-2: The set of values of parameter  $a$  for which the functions  $f(x)$  defined as  $f(x) = \tan(\sin x) + \left[ \frac{x^2}{a} \right]$  on the set  $[-3,3]$  is an odd function is ,  $[9, \infty)$

A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .

B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False , Statement-2 is True.

**Answer: B**

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7. Statement-1: If  $ad - bc \neq 0$ , then  $f(x) = \frac{ax + b}{cx + d}$  cannot attain the value  $\left\{ \frac{a}{c} \right\}$ .

Statement-2: The domain of the function  $g(x) = \frac{b - dx}{cx - a}$  is  $R - \left\{ \frac{a}{c} \right\}$

A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .

B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False , Statement-2 is True.

**Answer: A**

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8. Statement-1: The function  $f(x)$  given by

$f(x) = \sin^{-1}\left\{\log\left(x + \sqrt{x^2 + 1}\right)\right\}$  is an odd function.

Statement:2 The composition of two odd functions is an odd function.

A. Statement-1 is True, Statement-2 is True, statement-2 is a correct explanation for the statement-1 .

B. Statement-1 is True, Statement-2 is True, statement-2 is not a correct explanation for the statement-1 .

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False , Statement-2 is True.

**Answer: A**

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## Exercise

1. The function  $f(x) = \log_{10} \left( \frac{1+x}{1-x} \right)$  satisfies the equation

A.  $f(x+2) - 2cd(x+1) + f(x) = 0$

B.  $f(x+1) + f(x) = f(x(x+1))$

C.  $f(x_1(x_2)) = f(x_1 + x_2)$

D.  $f(x_1) + f_{x_2} = f \left( \frac{x_1 + x_2}{1 + x_1 x_2} \right)$

**Answer: D**

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2. If  $y = f(x)$  satisfies the condition  $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$  ( $x \neq 0$ )

then  $f(x) =$

A.  $x^2 - 2$  for all  $x \neq 0$

B.  $x^2 - 2$  for all  $x$  satisfying  $|x| \geq 2$

C.  $x^2 - 2$  for all  $x$  satisfying  $|x| < 2$

D. none of these

**Answer: B**



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3. If  $f(x + 2y, x - 2y) = xy$ , then  $f(x, y)$  equals

A.  $\frac{x^2 - y^2}{8}$

B.  $\frac{x^2 - y^2}{4}$

C.  $\frac{x^2 + y^2}{4}$

D.  $\frac{x^2 - y^2}{2}$



**Answer: A**



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4. If  $f(x) = x - \frac{1}{x}$ ,  $x \neq 0$  then  $f(x^2)$  equals.

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

B.  $f(x)f(-x)$

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

D. none of these

**Answer: D**



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5. A polynomial function  $f(x)$  satisfies the condition

$$f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right).$$

If  $f(10)=1001$ , then  $f(20)=$

A. 2002

B. 8008

C. 8001

D. none of these

**Answer: C**

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6. The function  $f(x) = \max \{(1 - x), (1 + x), 2\}$ ,  $x \in (-\infty, \infty)$  is equivalent to

$$\text{A. } f(x) = \begin{cases} 1 - x & x \leq -1 \\ 2 & -1 < x < 1 \\ 1 + x & x \geq 1 \end{cases}$$

$$\text{B. } f(x) = \begin{cases} 1 + x, x \leq -1 \\ 2, -1 < x < 1 \\ 1 - x, x \geq 1 \end{cases}$$

$$\text{C. } f(x) = \begin{cases} 1 - x, x \leq -1 \\ 1, -1 < x < 1 \\ 1 + x, x \geq 1 \end{cases}$$

D. none of these

**Answer: A**



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7. If  $f(x) = x^3 - x$  and  $\phi(x) = \sin 2x$ , then

A.  $\phi(f(2)) = \sin 2$

B.  $\phi(f(1)) = 1$

C.  $f(\phi(\pi/12)) = -\frac{3}{8}$

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

**Answer: C**



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8. Let  $f(x) = \min \{x, x^2\}$ , for every  $x \in R$ . Then

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

$$B. f(x) = \begin{cases} x^2, & x \geq 1 \\ x, & x < 1 \end{cases}$$

$$C. f(x) = \begin{cases} x, & x \geq 1 \\ x^2, & x < 1 \end{cases}$$

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

**Answer: A**



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9. The domain of the function  $f(x)$  given by  $f(x) = \frac{\sqrt{4-x^2}}{\sin^{-1}(2-x)}$  is

A.  $[0,2]$

B.  $[0,2)$

C.  $[1,2)$

D.  $[1,2]$

**Answer: C**



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10. The domain of the function

$$f(x) = \sqrt{\left\{ \frac{-\log_{0.3}(x-1)}{-x^2+3x+18} \right\}}$$
 is

(a)  $[2, 6]$  (b)  $]2, 6[$

(b)  $]2, 6[$  (d) None of these

A.  $[2,6]$

B.  $(2,6)$

C.  $[2,6)$

D. none of these

**Answer: B**



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11. Domain of the function,  $f(x) = \left[ \log_{10} \left( \frac{5x - x^2}{4} \right) \right]^{\frac{1}{2}}$  is

A.  $[1,4]$

B. (1,4)

C. (0,5)

D. [0,5]

**Answer: A**



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12. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = \frac{1}{2 - \cos 3x}$  for each  $x \in \mathbb{R}$  then the range of  $f$  is

A.  $[-1/3, 0]$

B.  $\mathbb{R}$

C.  $[1/3, 1]$

D. none of these

**Answer: C**



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13. If the function  $f: \mathbb{R} \rightarrow \mathbb{A}$  given by  $f(x) = \frac{x^2}{x^2 + 1}$  is surjection, then find

A.

A.  $\mathbb{R}$

B.  $[0,1]$

C.  $(0,1]$

D.  $[0,1)$

**Answer: D**



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14. The domain of definition of the function

$$f(x) = \frac{1}{\sqrt{|x| - x}}$$
 is

A.  $\mathbb{R}$

B.  $(0, \infty)$

C.  $(-\infty, 0)$

D. none of these

**Answer: C**



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15. The set of values of  $x$  for which the function

$$f(x) = \frac{1}{x} + 2^{\sin^{-1}x} + \frac{1}{\sqrt{x-2}}$$
 exists is

A.  $\mathbb{R}$

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

C.  $\phi$

D. none of these

**Answer: C**



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16. The function  $f(x) = \log_{10}(x + \sqrt{x^2 + 1})$  is

- A. an even function
- B. an odd function
- C. periodic function
- D. none of these

**Answer: B**



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17. The function  $f(x) = \cos\left\{\log_{10}\left(x + \sqrt{x^2 + 1}\right)\right\}$ , is

- A. even
- B. odd
- C. constant
- D. none of these

**Answer: A**



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18.  $f(x) = \sqrt{\sin^{-1}(\log_2 x)}$

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

B.  $s \in [1, 2]$

C.  $x \in [2, \infty)$

D.  $x \in (0, \infty)$

**Answer: B**



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19. The function  $f(x) = \sqrt{\cos(\sin x)} + \sin^{-1}\left(\frac{1+x^2}{2x}\right)$  is defined for :

A.  $x \in \{-1, 1\}$

B.  $x \in [-1, 1]$

C.  $x \in \mathbb{R}$

D.  $x \in (-1, 1)$

**Answer: A**



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20. The function  $f(x) = |\cos|$  is periodic with period

A.  $2\pi$

B.  $\pi$

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

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

**Answer: B**



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21. If a function  $f(x)$  is defined for  $x \in [0, 1]$ , then the function  $f(2x+3)$  is defined for

A.  $x \in [0, 1]$

B.  $x \in [-3/2, -1]$

C.  $x \in \mathbb{R}$

D.  $x \in [-3/2, 1]$

**Answer: B**



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22. the period of the  $f(x) = \sin^4 x + \cos^4 x$  is

A.  $\pi$

B.  $\pi/2$

C.  $2\pi$

D. none of these

**Answer: B**



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**23.** Which of the following functions is the inverse of itself?

$f(x) = \frac{1-x}{1+x}$  (b)  $f(x) = 5^{\log x}$   $f(x) = 2^{x(x-1)}$  (d) None of these

A.  $f(x) = \frac{1-x}{1+x}$

B.  $g(x) = 5^{\log x}$

C.  $h(x) = 2^{x(x-1)}$

D. none of these

**Answer: A**



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**24.** If  $f(-x) = -f(x)$ , then  $f(x)$  is

- A. an even function
- B. an odd function
- C. neither odd nor even
- D. periodic function

**Answer: B**

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25. The value of  $f(x) = 3 \sin\left(\frac{\pi^2}{16} - x^2\right)$  lie in the interval \_\_\_\_

- A.  $[-\pi/4, \pi/4]$
- B.  $[0, 3/\sqrt{2}]$
- C.  $(-3, 3)$
- D. none of these

**Answer: B**

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

- A.  $\frac{f(x)+1}{f(x)+3}$
- B.  $\frac{3f(x)+1}{f(x)+3}$
- C.  $\frac{f(x)+3}{f(x)+1}$
- D.  $\frac{f(x)+3}{3f(x)+1}$

**Answer: B**



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27. Given  $f(x) = \log_{10}\left(\frac{1+x}{1-x}\right)$  and  $g(x) = \frac{3x+x^3}{1+3x^2}$ , then  $\text{fog}(x)$

equals

- A.  $-f(x)$
- B.  $3f(x)$

C.  $[f(x)]^3$

D. none of these

**Answer: B**



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28. If  $f(x) = 2x^6 + 3x^4 + 4x^2$ , then  $f'(x)$  is

A. an even function

B. an odd function

C. neither even nor odd

D. none of the above

**Answer: B**



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29. If  $f(x)$  is an even function, then the curve  $y=f(x)$  is symmetric about

- A. x-axis
- B. y-axis
- C. both the axes
- D. none of these

**Answer: B**



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30. If  $f(x)$  is an odd function, then the curve  $y=f(x)$  is symmetric

- A. about x-axis
- B. about y-axis
- C. about both the axes
- D. in opposite quadrants

**Answer: D**



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**31.** Which of the following functions is periodic ?

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

B.  $f(x) = \cos \sqrt{x}$

C.  $f(x) = \cos x^2$

D.  $f(x) = \cos^2 x$

**Answer: D**



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**32.** Let the function  $f(x) = x^2 + x + \sin x - \cos x + \log(1 + |x|)$  be defined on the interval  $[0,1]$ . The odd extension of  $f(x)$  to the interval  $[-1,1]$

is

A.  $x^2 + x + \sin x + \cos x - \log(1 + |x|)$

B.  $-x^2 + x + \sin x + \cos x - \log(1 + |x|)$

C.  $-x^2 + x + \sin x - \cos x + \log(1 + |x|)$

D. none of these

**Answer: B**

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**33.** The domain of definition of the function  $f(x) = (7 - x)P_{x-3}$ , is

A.  $[3,7]$

B.  $\{3,4,5,6,7\}$

C.  $\{3,4,5\}$

D. none of these

**Answer: C**

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34. The range of function  $f(x) = {}^{7-x}P_{x-3}$  is {1,2,3} (b) {1, 2, 3, 4, 5, 6} {1, 2, 3, 4} (d) {1, 2, 3, 4, 5}

- A. {1,2,3}
- B. {1,2,3,4,5,6}
- C. {1,2,3,4}
- D. {1,2,3,4,5}

**Answer: A**



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35. If  $f(x) = \cos^{-1}\left(\frac{2 - |x|}{4}\right) + [\log_{10}(3 - x)]^{-1}$ , then its domain is

- A. [-2,6]
- B.  $[-6, 2) \cup (2, 3)$
- C.  $[-6, 2]$

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

**Answer: B**



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36. If D is the set of all real x such that  $1 - e^{\frac{1}{x}-1}$  is positive, then D is equal to

A.  $(-\infty, 1]$

B.  $(-\infty, 0)$

C.  $(1, \infty)$

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

**Answer: D**



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37. Which of the following functions has period  $2\pi$  ?

A.  $f(x) = \sin\left(2\pi x + \frac{\pi}{3}\right) + 2\sin\left(3\pi x + \frac{\pi}{4}\right) + 3\sin 5\pi x$

B.  $f(x) = \sin \frac{\pi x}{3} + \sin \frac{\pi x}{4}$

C.  $f(x) = \sin x + \cos 2x$

D. none of these

**Answer: C**



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38. If  $f(x) = a^x$ , which of the following equalities do not hold ? (i)

$f(x+2) - 2f(x+1) + f(x) = (a-1)^2 f(x)$  (ii)  $f(-x)f(x) - 1 = 0$

(iii)  $f(x+y) = f(x)f(y)$  (iv)

$f(x+3) - 2f(x+2) + f(x+1) = (a-2)^2 f(x+1)$

A.  $f(x+2) - 2f(x+1) + f(x) = (a-1)^2 f(x)$

B.  $f(-x)f(x) + 1 = 0$

C.  $f(x + y) = f(x) + f(y)$

D.  $f(x + 3) - 2f(x + 2) + f(x + 1) = (a - 2)^2 f(x + 1)$

**Answer: A**



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39. The interval in which the function  $y = f(x) = \frac{x - 1}{x^2 - 3x + 3}$

transforms the real line is

A.  $(0, \infty)$

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

C.  $[0, 1]$

D.  $[-1/3, 1] - \{0\}$

**Answer: D**



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40. Let  $f(x) = |x - 1|$ . Then,

A.  $f(x^2) = [f(x)]^2$

B.  $f(|x|) = |f(x)|$

C.  $f(x + y) = f(x) + f(y)$

D. none of these

Answer: D



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41. The function  $f: C \rightarrow C$  defined by  $f(x) = \frac{ax + b}{cx + d}$  for  $x \in C$  where

$bd \neq 0$  reduces to a constant function if

A.  $a = c$

B.  $b = c$

C.  $ad = bc$

D.  $ab = cd$



**Answer: C**



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**42.** If  $f(x)=ax+b$  and  $g(x)=cx+d$ , then  $f(g(x))=g(f(x))$  is equivalent to

A.  $f(a)=g(c)$

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

C.  $f(d) = g(b)$

D.  $f(c) = g(a)$

**Answer: C**



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**43.**  $x \frac{1 + 2(x + 4)^{-0.5}}{2 - (x + 4)^{0.5}} + 5(x + 4)^{0.5}$  Find the domain of the following function

A.  $\mathbb{R}$

B.  $(-4, 4)$

C.  $\mathbb{R}^+$

D.  $(-4, 0) \cup (0, \infty)$

**Answer: D**



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**44.** Which of the following functions is not an are not an insjective map(s) ?

A.  $f(x) = |x + 1|, x \in [-1, \infty)$

B.  $g(x) = x + \frac{1}{x}, x \in (0, \infty)$

C.  $h(x) = x^2 + 4x - 5, x \in (0, \infty)$

D.  $k(x) = e^{-x}, x \in [0, \infty)$

**Answer: B**



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45. The maximum possible domain and the corresponding range of

$$f(x) = (-1)^x$$

A.  $D = R, E = [-1, 1]$

B.  $D = \{ \text{the set of integers} \}, E = [-1, 1]$

C.  $D = R, E = [-1, 1]$

D.  $D = I, E = \begin{cases} +1 & \text{when } x = 0 \text{ or even} \\ -1 & \text{when } x \text{ is odd} \end{cases}$

Answer: D



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46. If  $f(x)$  is defined on  $[0, 1]$  by the rule  $f(x) = \begin{cases} x, & \text{if } x \text{ is rational} \\ 1 - x, & \text{if } x \text{ is irrational} \end{cases}$  then for all  $x \in [0, 1]$ ,  $f(f(x))$  is

A. constant

B.  $1+x$

C.  $x$

D. None of these

**Answer: C**



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47. The function  $f(x) = \frac{\sin^4 x + \cos^4 x}{x + \tan x}$  is :

A. even

B. odd

C. both even and odd

D. None of these

**Answer: B**



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48. The function  $f(x) = \frac{\sec^4 x + \csc^4 x}{x^3 + x^4 \cot x}$ , is

- A. even
- B. odd
- C. neither even nor odd
- D. periodic with period  $\pi$ .

**Answer: B**



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49. Let  $f(x)=x$  and  $g(x)=|x|$  for all  $x \in R$ . Then the function

$\phi(x)$  satisfying  $\{\phi(x) - f(x)\}^2 + \{\phi(x) - g(x)\}^2 = 0$  is

- A.  $\phi(x) = x, x \in [0, \infty)$
- B.  $\phi(x) = x, x \in R$
- C.  $\phi(x) = -x, x \in (-\infty, 0]$
- D.  $\phi(x) = x + |x|, x \in R$

**Answer: A**



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50. Let  $f: R \rightarrow R$  be a function defined by  $f(x) = \frac{|x|^3 + |x|}{1 + x^2}$ , then the graph of  $f(x)$  lies in the

A. I and II quadrants

B. I and III quadrants

C. II and III quadrants

D. III and IV quadrants .

**Answer: A**



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51. Let  $f(x) = \frac{ax + b}{cx + d}$ . Then the  $f \circ f(x) = x$ , provided that :  
( $a \neq 0, b \neq 0, c \neq 0, d \neq 0$ )

A.  $d=-a$

B.  $d=a$

C.  $a=b=c=d=1$

D.  $a=b=1$

**Answer: A**



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52. If  $f(x) = (ax^2 + b)^3$ , then find the function  $g$  such that  $f(g(x)) = g(f(x))$ .

A.  $g(x) = \left( \frac{b - x^{1/3}}{a} \right)^{1/2}$

B.  $g(x) = \frac{1}{(ax^2 + b)^3}$

C.  $g(x) = (ax^2 + b)^{1/3}$

D.  $g(x) = \left( \frac{x^{1/3} - b}{a} \right)^{1/2}$

**Answer: D**



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53. If a function  $f: [2, \infty] \rightarrow B$  defined by  $f(x) = x^2 - 4x + 5$  is a bijection, then  $B =$

A.  $\mathbb{R}$

B.  $[1, \infty)$

C.  $[4, \infty)$

D.  $[5, \infty)$

Answer: B



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54. If  $b^2 - 4ac = 0, a > 0$  then the domain of the function  $f(x) = \log(ax^3 + (a + b)x^2 + (b + c)x + c)$  is :

A.  $\mathbb{R} - \left\{ -\frac{b}{2a} \right\}$



B.  $R - \left\{ \left\{ -\frac{b}{2a} \right\} \cup \{x | x \geq -1\} \right\}$

C.  $R - \left\{ \left\{ -\frac{b}{2a} \right\} \cap (-\infty, -1] \right\}$

D. none of these

**Answer: C**



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55. If  $f(x) = \sin(\log x)$  then  $f(xy) + f\left(\frac{x}{y}\right) - 2f(x)\cos(\log y) =$  (A)  $\cos(\log x)$  (B)  $\sin(\log y)$  (C)  $\cos(\log(xy))$  (D) 0

A. -1

B. 0

C. 1

D. none of these

**Answer: B**



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56. The domain of the function  $f(x) = \sin^{-1} \log_3 \left( \frac{x}{3} \right)$  is

- A. [1,9]
- B. [-1,9]
- C. [-9,1]
- D. [-9,-1]

**Answer: A**



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57. The domain of the function  $f(x) = \frac{\sec^{-1} x}{\sqrt{x - [x]}}$ , where  $[x]$  denotes the greatest integers less than or equal to  $x$  is defined for all  $x$  belonging to

- A.  $R$
- B.  $R - \{(-1, 1) \cup \{n : n \in Z\}\}$
- C.  $R^+ - (0, 1)$

D.  $R^+ - [n : n \in N]$

**Answer: B**



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58. The domain of definition of the function  $f(x) = 3\sqrt{\frac{2x + 1}{x^2 - 10 - 11}}$ , is

A.  $(0, \infty)$

B.  $(-\infty, 0)$

C.  $R - \{-1, 11\}$

D.  $R$

**Answer: C**



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59. Let  $g(x)$  be a function defined on  $[-1,1]$ . If the area of the equilateral triangle with two of its vertices at  $(0,0)$  and  $(x, g(x))$  is  $\frac{\sqrt{3}}{4}$ , then the function  $g(x)$ , is

A.  $\pm \sqrt{1 - x^2}$

B.  $-\sqrt{1 - x^2}$  or  $\sqrt{1 - x^2}$

C.  $\sqrt{1 - x^2}$  only

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

**Answer: B**



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60. The domain of definition of the function

$$f(x) = \sin^{-1}\left(\frac{x-3}{2}\right) - \log_{10}(4-x), \text{ is}$$

A.  $1 \leq x \leq 5$

B.  $1 < x < 4$

C.  $1 \leq x < 4$

D.  $1 \leq x \leq 4$

**Answer: C**



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61. The domain of definition of  $f(x) = \sin^{-1}(|x - 1| - 2)$  is

A.  $[-2, 0] \cup [2, 4]$

B.  $(-2, 0) \cup (2, 4)$

C.  $[-2, 0] \cup [1, 3]$

D.  $[-2, 0] \cup [1, 3]$

**Answer: A**



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62. If  $f: R \rightarrow R$  are defined by  $f(x) = x - [x]$  and  $g(x) = [x]$  for  $x \in R$ , where  $[x]$  is the greatest integer not exceeding  $x$ , then for every  $x \in R$ ,  $f(g(x)) =$

A.  $x$

B.  $0$

C.  $f(x)$

D.  $g(x)$

**Answer: B**



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63. The domain of definition  $f(x) = \sqrt{\log_{0.4} \left( \frac{x-1}{x+5} \right)} \times \frac{1}{x^2 - 36}$  is

A.  $(-\infty, 0) - \{-6\}$

B.  $(0, \infty) - \{1, 6\}$

C.  $(1, \infty) - \{6\}$

D.  $[1, \infty) - \{6\}$

**Answer: C**



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**64.** The set of all  $x$  for which the none of the functions is defined

$$f(x) = \log_{(x-1)/(x+3)} 2 \text{ and } g(x) = \frac{1}{\sqrt{x^2 - 9}}, \text{ is}$$

A.  $[-3, 2]$

B.  $[-3, 2)$

C.  $(-3, 2]$

D.  $(-3, -2)$

**Answer: A**



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65. If  $f: R \rightarrow R$  is defined by  $f(x) = x - [x] - \frac{1}{2}$  for all  $x \in R$ , where  $[x]$  denotes the greatest integer function, then  $\left\{ x \in R: f(x) = \frac{1}{2} \right\}$  is equal to

A.  $Z$

B.  $N$

C.  $\phi$

D.  $R$

**Answer: C**



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66. The domain of definition of  $f(x) = \log_{10} \log_{10} \dots \log_{10} x$ , is

A.  $(10^n, \infty)$

B.  $(10^{n-1}, \infty)$

C.  $(10^{n-2}, \infty)$



D. none of these

**Answer: D**



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67. The domain of the function  $f(x) = \log_{10} \log_{10}(1 + x^3)$  is

A.  $(-1, \infty)$

B.  $(0, \infty)$

C.  $[0, \infty)$

D.  $(-1, \infty)$

**Answer: B**



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68. The domain of definition of the function

$$f(x) = \log_2 \left[ -(\log_2 x)^2 + 5 \log_2 x - 6 \right], \text{ is}$$

A.  $(4, 8)$

B.  $[4, 8]$

C.  $(0, 4) \cup (8, \infty)$

D.  $R - [4, 8]$

**Answer: A**



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69. The domain of definition of  $f(x) = \log_3 |\log_e x|$ , is

A.  $(1, \infty)$

B.  $(0, \infty)$

C.  $(e, \infty)$

D. none of these

**Answer: D**



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**70.** The domain of definition of the function

$$f(x) = \log_3 \left\{ -\log_4 \left( \frac{6x - 4}{6x + 5} \right) \right\}, \text{ is}$$

A.  $(2/3, \infty)$

B.  $(-\infty, -5/6) \cup (2/3, \infty)$

C.  $[2/3, \infty)$

D.  $(-5/6, 2/3)$

**Answer: A**



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**71.** The domain of definition of the function  $f(X) = x^{\frac{1}{\log_{10} x}}$ , is

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

B.  $(0, \infty)$

C.  $[0, \infty)$

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

**Answer: A**

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72. The domain of the function  $f(x) = \frac{1}{\sqrt{|\cos x| + \cos x}}$  is

A.  $[-2n\pi, 2n\pi], n \in \mathbb{N}$

B.  $(2n\pi, (2n + 1)\pi), n \in \mathbb{Z}$

C.  $\left( (4n + 1)\frac{\pi}{2}, (4n + 3)\frac{\pi}{2} \right), n \in \mathbb{Z}$

D.  $\left( (4n - 1)\frac{\pi}{2}, (4n + 1)\frac{\pi}{2} \right), n \in \mathbb{Z}$

**Answer: D**

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73. If the function  $f(x) = \log(x - 2) - \log(x - 3)$  and  $g(x) = \log\left(\frac{x - 2}{x - 3}\right)$  are identical, then

- A.  $x \in [2, 3]$
- B.  $x \in [2, \infty)$
- C.  $x \in (3, \infty)$
- D.  $x \in R$

**Answer: C**



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74. The domain of definition of the function  $f(x) = \sin^{-1}\left(\frac{4}{3 + 2 \cos x}\right)$ , is

- A.  $\left[2n\pi - \frac{\pi}{3}, 2n\pi + \frac{\pi}{3}\right], n \in Z$

B.  $\left[0, 2n\pi + \frac{\pi}{6}\right], n \in \mathbb{Z}$

C.  $\left[2n\pi - \frac{\pi}{6}, 0\right], n \in \mathbb{Z}$

D.  $\left(2n\pi - \frac{\pi}{6}, 2n\pi + \frac{\pi}{6}\right), n \in \mathbb{Z}$

**Answer: A**



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75. The domain of the function  $f(x) = \cos^{-1}[\sec x]$ , where  $[x]$  denotes the greatest integer less than or equal to  $x$ , is

A.

$$\{x : x = (2n + 1)\pi, n \in \mathbb{Z}\} \cup \left\{x : 2m\pi \leq x < 2m\pi + \frac{\pi}{3}, m \in \mathbb{Z}\right\}$$

B.

$$\{x : x = 2n\pi, n \in \mathbb{Z}\} \cup \{x : 2m\pi < (x = 2n\pi), n \in \mathbb{Z}\} \cup \left\{x : 2m\pi < x < 2m\pi + \frac{\pi}{3}, m \in \mathbb{Z}\right\}$$

C.  $\{x : (2n + 1)\pi, n \in \mathbb{Z}\} \cup \left\{x : 2m\pi < x < 2m\pi + \frac{\pi}{3}, m \in \mathbb{Z}\right\}$

D. none of these

**Answer: A**



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76. Let  $f$  be a real valued function with domain  $R$  such that  $f(x + 1) + f(x - 1) = \sqrt{2}f(x)$  for all  $x \in R$ , then ,

- A.  $f(x)$  is a periodic function with period 8
- B.  $f(x)$  is a periodic function with period 12
- C.  $f(x)$  is a non-periodic function
- D.  $f(x)$  is a periodic function with indeterminate period

**Answer: A**



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77. Let  $f$  be a real valued function with domain  $R$  satisfying

$$f(x + k) = 1 + \left[ \left( 2 - 5f(x) + 10\{f(x)\}^2 - 10\{f(x)\}^3 + 5\{f(x)\}^4 - \{f(x)\}^5 \right) \right]$$

for all real  $x$  and some positive constant  $k$ , then the period of the function  $f(x)$

- A. a periodic function with period  $\lambda$
- B. a periodic function with period  $2\lambda$  .
- C. not a periodic function
- D. a periodic function with indeterminate period.

**Answer: B**

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78. The function  $f(x)$  given by  $f(x) = \frac{\sin 8x \cos x - \sin 6x \cos 3x}{\cos x \cos 2x - \sin 3x \sin 4x}$ , is

- A. periodic with period  $\pi$
- B. periodic with period  $2\pi$
- C. periodic with period  $\pi/2$
- D. not periodic



**Answer: C**



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**79.** If  $f(x)$  and  $g(x)$  are two real functions such that  $f(x) + g(x) = e^x$  and  $f(x) - g(x) = e^{-x}$ , then

- A.  $f(x)$  is an odd function
- B.  $g(x)$  is an even function
- C.  $f(x)$  and  $g(x)$  are periodic functions.
- D. none of these

**Answer: D**



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**80.** Let  $f(x) = |x - 2| + |x - 3| + |x - 4|$  and  $g(x) = f(x + 1)$ . Then 1.  $g(x)$  is an even function 2.  $g(x)$  is an odd function 3.  $g(x)$  is neither even

nor odd 4.  $g(x)$  is periodic

- A.  $g(x)$  is an even functions
- B.  $g(x)$  is an odd function
- C.  $g(x)$  is neither even nor odd
- D.  $g(x)$  is periodic .

**Answer: C**



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81. If  $T_1$  is the period of the function  $f(x) = e^{3(x - [x])}$  and  $T_2$  is the period of the function  $g(x) = e^{3x - [3x]}$  ( $[\cdot]$  denotes the greatest integer function), then

- A.  $T_1 = T_2$
- B.  $T_1 = \frac{T_2}{3}$
- C.  $T_1 = 3T_2$

D. none of these

**Answer: C**

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82. If  $f(x) = \sqrt{|3^x - 3^1| - 2}$  and  $g(x) = \tan \pi x$ , then domain of  $f \circ g(x)$ , is

A.  $\left[ n + \frac{1}{3}, n + \frac{1}{2} \right] \cup \left[ n + \frac{1}{2}, n + 1 \right], n \in \mathbb{Z}$

B.  $\left( n + \frac{1}{4}, n + \frac{1}{2} \right) \cup \left( n + \frac{1}{2}, n + 1 \right), n \in \mathbb{Z}$

C.  $\left( n + \frac{1}{4}, n + \frac{1}{2} \right) \cup \left[ n - \frac{1}{2}, n + 1 \right], n \in \mathbb{Z}$

D.  $\left[ n + \frac{1}{4}, n + \frac{1}{2} \right] \cup \left( n + \frac{1}{2}, n + 1 \right), n \in \mathbb{Z}$

**Answer: B**

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83. Find the range of  $f(x) = \sqrt{\sin(\cos x)} + \sqrt{\cos(\sin x)}$ .

- A.  $[\sqrt{\cos 1}, \sqrt{\sin 1}]$
- B.  $[\sqrt{\cos 1}, 1 + \sqrt{\sin 1}]$
- C.  $[1 - \sqrt{\cos 1}, \sqrt{\sin 1}]$
- D. none of these

**Answer: B**



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

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

**Answer: B**



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85. If  $f: R \rightarrow R$  and  $g: R \rightarrow R$  are defined by  $f(x) = 2x + 3$  and  $g(x) = x^2 + 7$ , then the values of  $x$  such that  $g(f(x)) = 8$  are

A. 1, 2

B. -1, 2

C. -1, -2

D. 1, -2

**Answer: C**



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86. Suppose  $f: [-2, 2] \rightarrow \mathbb{R}$  is defined by

$$f(x) = \begin{cases} -1 & \text{for } -2 \leq x \leq 0 \\ x - 1 & \text{for } 0 \leq x \leq 2 \end{cases},$$

then

$$\{x \in [-2, 2] : x \leq 0 \text{ and } f(|x|) = x\} =$$

- A.  $\{-1\}$
- B.  $\{0\}$
- C.  $\{-1/2\}$
- D.  $\phi$

**Answer: C**

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87. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  and  $g: \mathbb{R} \rightarrow \mathbb{R}$  is given by  $f(x) = |x|$  and  $g(x) = [x]$  for each  $x \in \mathbb{R}$  then  $\{x \in \mathbb{R} : g(f(x)) \leq f(g(x))\}$

- A.  $\mathbb{Z} \cup (-\infty, 0)$
- B.  $(-\infty, 0)$

C. Z

D. R

**Answer: A**



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88. If  $a, b$  are two fixed positive integers such that  $f(a + x) = b + \left[ b^3 + 1 - 3b^2 f(x) + 3b\{f(x)\}^2 - \{f(x)\}^3 \right]^{\frac{1}{3}}$  for all real  $x$ , then prove that  $f(x)$  is periodic and find its period.

A. a

B. 2a

C. b

D. 2b

**Answer: B**



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89. The domain of the function  $f(x) = \log_{3+x}(x^2 - 1)$  is

- A.  $(-3, -1) \cup (1, \infty)$
- B.  $[-3, -1) \cup [1, \infty)$
- C.  $(-3, -2) \cup (-2, -1) \cup (1, \infty)$
- D.  $[-3, -2) \cup (-2, -1) \cup [1, \infty)$

**Answer: C**



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90. Period of  $f(x) = \sin 3x \cos[3x] - \cos 3x \sin[3x]$  (where  $[\ ]$  denotes the greatest integer function), is

- A.  $\frac{1}{2}$
- B.  $\frac{1}{3}$
- C. 1



D. 3

**Answer: B**



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91. Let  $f(x) = \frac{1}{x}$  and  $g(x) = \frac{1}{\sqrt{x}}$ . Then,

- A.  $f(g(x))$  and  $g(f(x))$  have different domains
- B.  $f(g(x))$  and  $g(f(x))$  have same domain
- C.  $g(f(x))$  is a bijective mapping
- D.  $f(g(x))$  is neither odd or even.

**Answer: B**



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92.

Domain

of

$$\left(\sqrt{s^2 - 4x + 3} + 1\right) \log_{\frac{x}{5}} \left(\frac{x}{5}\right) + \frac{1}{x} \left(\sqrt{8x - 2x^2 - 6} + 1\right) \leq 1$$
 is

A.  $(-\infty, 1] \cup [3, \infty)$

B.  $[1, 3]$

C.  $\{1, 3\}$

D.  $\{1\}$

**Answer: D**[Watch Video Solution](#)

93. The period of the function

$$f(x) = \cos 2\pi\{2x\} + \sin 2\pi\{2x\},$$

is ( where  $\{x\}$  denotes the functional part of  $x$ )

A. 1

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

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

D.  $\pi$

**Answer: C**



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94. If  $f(n + 2) = \frac{1}{2} \left\{ f(n + 1) + \frac{9}{f(n)} \right\}$ ,  $n \in N$  and  $f(n) > 0$  for all  $n \in N$ , then  $\lim_{n \rightarrow \infty} f(n)$  is equal to

A. 3

B. -3

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

D. none of these

**Answer: A**



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95.

Let

$$f(x) = \begin{cases} \left(x^2 \sin\left(\frac{\pi x}{2}\right), & -1 < x < 1, x \neq 0 \right), \\ (x|x|, & x > 1 \text{ or } x \leq -1) \end{cases}$$

. Then ,

- A.  $f(x)$  is an odd function
- B.  $f(x)$  is an even function
- C.  $f(x)$  is neither odd nor even
- D. none of these

**Answer: A**



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## Chapter Test

1. The period of the function  $f(x) = \sin^4 3x + \cos^4 3x$ , is

- A.  $\pi/2$

B.  $\pi/3$

C.  $\pi/6$

D. none of these

**Answer: C**

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2. The value of integer  $n$  for which the function  $f(x) = \frac{\sin x}{\sin(\frac{x}{n})}$  has  $4\pi$  its period is

A. 2

B. 3

C. 5

D. 4

**Answer: A**

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3. The period of the function  $f(x) = \sin\left(\frac{2x + 3}{6\pi}\right)$ , is

A.  $2\pi$

B.  $6\pi$

C.  $6\pi^2$

D. none of these

**Answer: C**



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4. The domain of the function  $f(x) = \sqrt{\log\left(\frac{1}{|\sin x|}\right)}$

A.  $R - \{-\pi, \pi\}$

B.  $R - \{n\pi \mid n \in Z\}$

C.  $R - \{2n\pi \mid n \in z\}$

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

**Answer: B**



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5. Domain of the function  $f(x) = \log(\sqrt{x-4} + \sqrt{6-x})$

A.  $[4,6]$

B.  $(-\infty, 6)$

C.  $(2, 3)$

D. none of these

**Answer: A**



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6. Let  $f(x) = \frac{\sqrt{\sin x}}{1 + 3\sqrt{\sin x}}$  then domain  $f$  contains

A.  $(0, \pi)$

B.  $(-2\pi, -\pi)$

C.  $(3\pi, 4\pi)$

D.  $(4\pi, 6\pi)$

**Answer: A**



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

A.  $[0,1]$

B.  $\{0,1\}$

C.  $(0, \infty)$

D.  $(-\infty, 0]$

**Answer: B**



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8. If  $N$  denotes the set of all positive integers and if  $f: N \rightarrow N$  is defined by  $f(n) =$  the sum of positive divisors of  $n$  then  $f(2^k \cdot 3)$ , where  $k$  is a positive integer is

A.  $2^{k+1} - 1$

B.  $2(2^{k+1} - 1)$

C.  $3(2^{k+1} - 1)$

D.  $4(2^{k+1} - 1)$

**Answer: C**

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9. The set of value of  $a$  for which the function  $f(x) = \sin x + \left[ \frac{x^2}{a} \right]$  defined on  $[-2,2]$  lies an odd function , is

A.  $(4, \infty)$

B.  $[-4, 4]$

C.  $(-\infty, 4)$

D. none of these

**Answer: A**



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10. If  $f(x) = \begin{cases} -1 & x < 0 \\ 0 & x = 0 \\ 1 & x > 0 \end{cases}$  and  $g(x) = x(1 - x^2)$ , then

A.

$$f \circ g(x) = \{( - 1, - 1 < x < 0 \text{ or } x > 1), (0, x = 0, 1, - 1), (1, 0 < x < 1)\}$$

B.

$$f \circ g(x) = \{( - 1, - 1 < x < 0), (0, x = 0, 1, - 1), (1, 0 < x < 1)\}$$

C.

$$f \circ g(x) = \{(-1, -1 < x < 0 \text{ or } x > 1), (0, x = 0, 1, -1), (1, 0 < x < 1)\}$$

D.

$$f \circ g(x) = \{(-1, x < 0 \text{ or } x > 1), (0, x = 0, 1, -1), (1, 0 < x < 1)\}$$

**Answer: C**



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11. Find the equivalent definition of

$$f(x) = \max\{x^2, (1-x)^2, 2x(1-x)\} \text{ where } 0 \leq x \leq 1$$

$$\text{A. } f(x) = \begin{cases} x^2 & 0 \leq x \leq 1/3 \\ 2x(1-x) & 1/3 \leq x \leq 2/3 \\ (1-x)^2 & 2/3 \leq x \leq 1 \end{cases}$$

$$\text{B. } f(x) = \begin{cases} (1-x)^2 & 0 \leq x \leq 1/3 \\ 2x(1-x) & 1/3 \leq x \leq 2/3 \\ x^2 & 2/3 \leq x \leq 1 \end{cases}$$

$$\text{C. } f(x) = \begin{cases} x^2 & 0 \leq x \leq 1/2 \\ (1-x)^2 & 1/2 \leq x \leq 1 \end{cases}$$

D. none of these

**Answer: B**



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12. If  $f(x)$  is defined on  $[0,1]$ , then the domain of  $f(3x^2)$ , is

A.  $[0, 1/\sqrt{3}]$

B.  $[-1/\sqrt{3}, 1/\sqrt{3}]$

C.  $[-\sqrt{3}, \sqrt{3}]$

D. none of these

**Answer: B**



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13. The function  $f(x)$  is defined in  $[0, 1]$ . Find the domain of  $f(\tan x)$ .

A.  $[n\pi, n\pi + \pi/4], n \in \mathbb{Z}$

B.  $[2n\pi, 2n\pi + \pi/4], n \in \mathbb{Z}$

C.  $[n\pi - \pi/4, n\pi + \pi/4], n \in \mathbb{Z}$

D. none of these

**Answer: A**



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14. The domain of definition of the real function  $f(x) = \sqrt{\log_{12} x^2}$  of the real variable  $x$ , is

A.  $x > 0$

B.  $|x| > 1$

C.  $|x| > 4$

D.  $x > 4$

**Answer: B**



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15. The values of  $b$  and  $c$  for which the identity of  $f(x + 1) - f(x) = 8x + 3$  is satisfied, where  $f(x) = bx^2 + cx + d$ , are

A.  $b=2, c=1$

B.  $b=4, c=-1$

C.  $b=-1, c=4$

D.  $b=-1, c=1$

**Answer: B**



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16. The function  $f(x) = \sin \frac{\pi x}{2} + 2 \cos \frac{\pi x}{3} - \tan \frac{\pi x}{4}$  is periodic with period

A. 6

B. 3

C. 4

D. 12

**Answer: D**



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17. The period of the function  $\sin\left(\frac{\pi x}{2}\right) + \cos\left(\frac{\pi x}{2}\right)$ , is

A. 4

B. 6

C. 12

D. 24

**Answer: A**



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18. The equivalent definition of

$$f(x) = \max \left\{ -1|1 - x^2|, 2|x| - 2, 1 - \frac{7}{2}|x| \right\}, \text{ is}$$

A.

$$\left\{ (-2x + 2, x - 1), (x^2 - 1, -1 \leq x < 1/2), (1 + 7x/22, -1/2 \leq x < 1) \right\}$$

B.

$$\left\{ (-2x - 2, x < -1), (-x^2 - 1, -1 \leq x < 1/2), (1 + 7x/22, -1/2 \leq x < 1) \right\}$$

C.

$$\left\{ (-2x + 2, x \leq -1), (x^2 - 1), -1 \leq x < 0), (1 + 7x, 0 \leq x < 1) \right\}$$

D. none of these

**Answer: A**



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



A.  $2 \tan^{-1} x$

B. 
$$\begin{cases} -\pi - 2 \tan^{-1} x & -\infty < x < -1 \\ 2 \tan^{-1} x & -1 \leq x \leq 1 \\ \pi - 2 \tan^{-1} x & 1 < x < \infty \end{cases}$$

C. 
$$\begin{cases} -\pi - 2 \tan^{-1} x & -\infty < x < -1 \\ 2 \tan^{-1} x & -1 \leq x \leq 1 \\ \pi - 2 \tan^{-1} x & 1 < x < \infty \end{cases}$$

D. 
$$\begin{cases} -\pi + 2 \tan^{-1} x & -\infty < x \leq -1 \\ 2 \tan^{-1} x & -1 < x < 1 \\ \pi - 2 \tan^{-1} x & 1 \leq x < \infty \end{cases}$$

Answer: B



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

A.  $2 \tan^{-1} x$

B. 
$$\begin{cases} 2 \tan^{-1} x & x \geq 0 \\ -2 \tan^{-1} x & x \leq 0 \end{cases}$$

C. 
$$\begin{cases} \pi + 2 \tan^{-1} x & x \geq 0 \\ -\pi + 2 \tan^{-1} x & x \leq 0 \end{cases}$$

D. none of these

**Answer: B**



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21. The equivalent definition of the function

$$f(x) = \lim_{n \rightarrow \infty} \frac{x^n - x^{-n}}{x^n + x^{-n}}, x > 0, \text{ is}$$

$$\text{A. } f(x) = \begin{cases} -1 & 0 < x \leq 1 \\ 1 & x > 1 \end{cases}$$

$$\text{B. } f(x) = \begin{cases} -1 & 0 < x < 1 \\ 1 & x \geq 1 \end{cases}$$

$$\text{C. } f(x) = \begin{cases} -1 & 0 < x < 1 \\ 0 & x = 1 \\ 1 & x > 1 \end{cases}$$

D. none of these

**Answer: C**



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22. Find the domain of  $\log_{10}(1 - \log_{10}(x^2 - 5x + 16))$

A. (1,3)

B. (2,3)

C. [2,3]

D. none of these

**Answer: B**

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23. The domain of definition of  $f(x) = \log_{0.5} \left\{ -\log_2 \left( \frac{3x-1}{3x+2} \right) \right\}$ , is

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

B.  $(-1/3, \infty)$

C.  $(1/3, \infty)$

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

**Answer: C**

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24. The domain of definition of  $f(x) = \sqrt{\frac{\log_{0.3}|x-2|}{|x|}}$ , is

A.  $[1, 2) \cup (2, 3]$

B.  $[1, 3]$

C.  $R - (1, 3]$

D. none of these

**Answer: A**



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25. The domain of the function

$$y = \sqrt{\log_{10}(\log_{10} x) - \log_{10}(4 - \log_{10} x) - \log_{10} 3}$$
 is

A.  $(10^3, 10^4)$

B.  $[10^3, 10^4]$

C.  $[10^3, 10^4)$

D.  $(10^3, 10^4]$

**Answer: C**

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26. The function  $f(x) = \log_{2x-5}(x^2 - 3x - 10)$  is defined for all  $x$  belonging to

A.  $[5, \infty)$

B.  $(5, \infty)$

C.  $(-\infty, +5)$

D. none of these

**Answer: B**

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27. The domain of definition of  $f(x) = \log_{1.7} \left( \frac{2 - \phi'(x)}{x + 1} \right)^{1/2}$ , where  $\phi(x) = \frac{x^3}{3} - \frac{3}{2}x^2 - 2x + \frac{3}{2}$ , is

- A.  $(-\infty, -4)$
- B.  $(-4, \infty)$
- C.  $(-\infty, -1) \cup (-1, 4)$
- D.  $(-\infty, -1) \cup (-1, 4]$

**Answer: C**



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28. The domain of definition of  $f(x) = \log_{100x} \left( \frac{2 \log_{10} x + 1}{-x} \right)$ , is

- A.  $(0, 10^{-2}) \cup (10^{-2}, 10^{-1/2})$
- B.  $(0, 10^{-1/2})$
- C.  $(0, 10^{-1})$
- D. none of these

**Answer: A**



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29. The value of  $x$  for which  $y = \log_2 \left\{ -\log_{1/2} \left( 1 + \frac{1}{x^{1/4}} \right) - 1 \right\}$  is a real number are

A.  $[0,1]$

B.  $(0,1)$

C.  $[1, \infty)$

D. none of these

**Answer: B**



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30. Find the domain of the function

$$f(x) = \log_{10} \left( (\log_{10} x^2) - 5 \log_{10} x + 6 \right)$$

A.  $(0, 10^2)$

B.  $(10^3, \infty)$

C.  $(10^2, 10^3)$

D.  $(0, 10^2) \cup (10^3, \infty)$

**Answer: D**

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31. Domain of the function  $f(x) = (x + 0.5)^{\log(0.5+x)} \left( \frac{x^2 + 2x - 3}{4x^2 - 4x - 3} \right)$

A.  $(-1/2, 1)$

B.  $(-1/2, 1/2) \cup (1/2, 1) \cup (3/2, \infty)$

C.  $(-1/2 - 1)$

D. none of these

**Answer: B**

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32. Domain of definition of the function  $f(x) = \frac{3}{4-x^2} + \log_{10}(x^3 - x)$  is (A)  $(-1, 0) \cup (1, 2) \cup (2, \infty)$  (B)  $(-1, 0) \cup (1, 2)$  (C)  $(1, 2)$  (D)  $(1, 2) \cup (2, \infty)$

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

B.  $(1, 2)$

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

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

**Answer: A**



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33. The equivalent definition of  $f(x) = ||x| - 1|$ , is

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

$$B. f(x) = \begin{cases} x - 1 & x \leq -1 \\ x + 1 & -1 < x \leq 0 \\ x - 1 & 0 \leq x \leq 1 \\ x + 1 & x \geq 1 \end{cases}$$

$$C. f(x) = \begin{cases} x + 1 & x \geq 0 \\ x + 1 & x \leq 0 \end{cases}$$

D. none of these

**Answer: A**



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**34.** If  $f(x) = |x| - 1$ , then  $f \circ f(x)$  equals

$$A. f(x) = \begin{cases} |x| - 2 & |x| \leq 2 \\ 2 - |x| & 1 < |x| < 2 \\ |x| & |x| \leq 1 \end{cases}$$

$$B. f(x) = \begin{cases} |x| + 2 & |x| \leq 2 \\ |x| - 2 & 1 \leq |x| \leq 2 \\ |x| & |x| \leq 1 \end{cases}$$

$$C. f(x) = \begin{cases} |x| + 2 & |x| \geq 2 \\ 2 + |x| & 1 \leq |x| \leq 2 \\ |x| & |x| \leq 1 \end{cases}$$

D. none of these

**Answer: A**



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35.

$$f(x) = x^2 - 2|x|, g(x) = \min f(t) : 0 \leq t \leq x, -2 \leq x \leq 0 \text{ and } \max f(t) : 0 \leq t \leq x, 0 \leq x \leq 3$$

Sketch the graph of  $g(x)$  and discuss its differentiability

$$\text{A. } \begin{cases} x^2 - 2x & -2 \leq x \leq -1 \\ -1 & 1 \leq x < 0 \\ 0 & 0 \leq x < 2 \\ x^2 + 2x & 2 \leq x \leq 3 \end{cases}$$

$$\text{B. } \begin{cases} x^2 + 2x & -2 \leq x \leq -1 \\ -1 & -1 \leq x < 0 \\ 0 & 0 \leq x < 1 \\ x^2 - 2x & 1 \leq x \leq 3 \end{cases}$$

$$\text{C. } \begin{cases} x^2 + 2x & -2 \leq x \leq -1 \\ x^2 - 2x & 0 \leq x \leq 3 \end{cases}$$

$$\text{D. } \begin{cases} x^2 + 2x & -2 \leq x \leq 0 \\ 0 & 0 \leq x < 2 \\ x^2 - 2x & 2 \leq x \leq 3 \end{cases}$$

Answer: B



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36. Find the range of  $f(x) = \sec\left(\frac{\pi}{4}\cos^2 x\right)$ , where  $x \in \mathbb{R}$

- A.  $[1, \sqrt{2}]$
- B.  $[1, \infty)$
- C.  $[-\sqrt{2}, -1] \cup [1, \sqrt{2}]$
- D.  $(-\infty, -1] \cup [1, \infty)$

**Answer: A**



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37. The period of  $f(x) = \sin\left(\frac{\pi x}{n-1}\right) + \cos\left(\frac{\pi x}{n}\right)$ ,  $n \in \mathbb{Z}$ ,  $n > 2$ , is

- A.  $2n\pi(n-1)$
- B.  $4(n-1)\pi$
- C.  $2n(n-1)$
- D. none of these

**Answer: C**



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**38.** The function  $f(x) = \left(\frac{1}{2}\right)^{\sin x}$ , is

- A. periodic with period  $2\pi$
- B. an odd function
- C. not expressible as the sum of an even function and an odd function
- D. none of these

**Answer: A**



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**39.** If  $[x]$  and  $\{x\}$  represent the integral and fractional parts of  $x$ , respectively, then the value of  $\sum_{r=1}^{2000} \frac{\{x+r\}}{2000}$  is  $x$  (b)  $[x]$  (c)  $\{x\}$  (d)  $x + 2001$

A.  $\frac{2001}{2}x$

B.  $x + 2000$

C.  $x$

D.  $[x] + \frac{2001}{2}$

**Answer: C**



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40. Let  $f(x) = \begin{cases} 0 & x = 0 \\ x^2 \sin \pi / 2x & |x| < 1 \\ x|x| & |x| \geq 1 \end{cases}$ . Then,  $f(x)$  is

A. an even function

B. an odd function

C. neither an even function nor an odd function

D.  $f'(x)$  is an even function

**Answer: B**

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41. Let  $f(x) = x + 1$  and  $\phi(x) = x - 2$ . Then the value of  $x$  satisfying  $|f(x) + \phi(x)| = |f(x)| + |\phi(x)|$  are :

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

**Answer: B**

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42. The domain of definition of the function  $f(x) = \tan\left(\frac{\pi}{[x + 2]}\right)$ , is

- A.  $[-2, 1]$
- B.  $(-2, -1)$

C.  $R - [-2, -1]$

D. none of these

**Answer: D**



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43. The range of the function  $f(x) = \sin \left\{ \log_{10} \left( \frac{\sqrt{4-x^2}}{1-x} \right) \right\}$ , is

A.  $[0,1]$

B.  $(-1,0)$

C.  $[-1,1]$

D.  $(-1,1)$

**Answer: C**



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44. The range of the function  $y = \frac{x + 2}{x^2 - 8x + 4}$

A.  $\left(-\infty, -\frac{1}{4}\right] \cup \left[-\frac{1}{20}, \infty\right)$

B.  $\left(-\infty, -\frac{1}{4}\right) \cup \left(-\frac{1}{20}, \infty\right)$

C.  $\left(-\infty, -\frac{1}{4}\right] \cup \left(-\frac{1}{20}, \infty\right)$

D. none of these

**Answer: B**



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45. The range of the function

$f(x) = 1 + \sin x + \sin^3 x + \sin^5 x + \dots$  when  $x \in (-\pi/2, \pi/2)$ , is

A. (0,1)

B. R

C. (-2,2)

D. none of these

**Answer: B**



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**46.** The period of the function  $f(x) = |\sin 3x| + |\cos 3x|$ , is

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

B.  $\frac{\pi}{6}$

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

D.  $\pi$

**Answer: B**



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**47.** The function  $f(x) = \begin{cases} 1 & x \in Q \\ 0 & x \notin Q \end{cases}$ , is

A. periodic with period 1

B. periodic with period 2

C. not periodic

D. periodic with indeterminate period .

**Answer: D**



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**48.** Which of the following functions has period  $\pi$  ?

A.  $|\tan x| + \cos 2x$

B.  $2 \sin \frac{\pi x}{3} + 3 \cos \frac{2\pi x}{3}$

C.  $6 \cos \left( 2\pi x + \frac{\pi}{4} \right) + 5 \sin \left( \pi x + \frac{3\pi}{4} \right)$

D.  $|\tan 2x| + |\sin 4x|$

**Answer: A**



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49. The function  $f(x) = x[x]$ , is

- A. periodic with period 1
- B. periodic with period 2
- C. periodic with indeterminate period
- D. not- periodic

**Answer: D**



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50. If  $f(x)$  and  $g(x)$  are periodic functions with the same fundamental period where  $f(x) = \sin \alpha x + \cos \alpha x$  and  $g(x) = |\sin x| + |\cos x|$ , then  $\alpha$  is equal to (1) 0 (2) 2 (3) 4 (4) 8

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

D. 4

**Answer: D**



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51. The range of the function  $f(x) = \cos e c^{-1}[\sin x]$  in  $[0, 2\pi]$ , where  $[\cdot]$  denotes the greatest integer function, is

- A.  $[0, \pi/2) \cup (\pi, 3\pi/2]$
- B.  $\{-\pi/2\}$  and  $\{\pi/2\}$
- C.  $(0, \pi] \cup \{3\pi/2\}$
- D.  $(\pi/2, \pi) \cup (3\pi/2, 2\pi)$

**Answer: B**



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52. If  $f(\sin x) - f(-\sin x) = x^2 - 1$  is defined for all  $x \in R$ , then the value of  $x^2 - 2$  can be

A. 0

B. 1

C. 2

D. -1

**Answer: D**



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53. Let  $f: [\pi, 3\pi/2] \rightarrow R$  be a function given by

$$f(x) = [\sin x] + [1 + \sin x] + [2 + \sin x]$$

Then, the range of  $f(x)$  is

A.  $\{0, 3\}$

B.  $\{1\}$

C.  $\{0, 2\}$

D.  $\{3\}$

**Answer: A**

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54. Let the function  $f(x) = 3x^2 - 4x + 5 \log(1 + |x|)$  be defined on the interval  $[0,1]$ . The even extension of  $f(x)$  to the interval  $[0,1]$ . The even extension of  $f(x)$  to the interval  $[-1,1]$  is

A.  $3x^2 + 4x + 8 \log(1 + |x|)$

B.  $3x^2 - 4x + 8 \log(1 + |x|)$

C.  $3x^2 + 4x - 8 \log(1 + |x|)$

D. none of these

**Answer: D**

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55. If  $f: [-4, 0] \rightarrow \mathbb{R}$  is defined by  $f(x) = e^x + \sin x$ , its even extension to  $[-4, 4]$  is given by :

A.  $-e^{|x|} - \sin|x|$

B.  $e^{-|x|} - \sin|x|$

C.  $e^{-|x|} + \sin|x|$

D.  $-e^{-|x|} + \sin|x|$

**Answer: B**



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56. Which one of the following is not periodic ?

A.  $|\sin 3x| + \sin^2 x$

B.  $\cos \sqrt{x} + \cos^2 x$

C.  $\cos 4x + \tan^2 x$



D.  $\cos 2x + \sin x$

**Answer: B**



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

A.  $[2,4]$

B.  $(2, 3) \cup (3, 4]$

C.  $[2, 3)$

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

**Answer: B**



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58. The domain of  $f(x) = \log|\log_e x|$ , is

A.  $(0, \infty)$

B.  $(1, \infty)$

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

D.  $(-\infty, 1)$

**Answer: C**



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**59.** The period of  $\sin^2 \theta$ , is

A.  $\pi^2$

B.  $\pi$

C.  $2\pi$

D.  $\pi/2$

**Answer: B**



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60. The domain of the function  $f(x) = {}^{16-x}C_{2x-1} + {}^{20-3x}P_{4x-5}$ , where the symbols have their usual meanings, is the set

- A.  $\{2, 3\}$
- B.  $\{2, 3, 4\}$
- C.  $\{1, 2, 3, 4\}$
- D.  $\{1, 2, 3, 4, 5\}$

**Answer: A**



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