



MATHS

BOOKS - CENGAGE MATHS (HINGLISH)

FUNCTIONS

Multiple Correct Answers Type

1. The function $f(x) = \cos^{-1}\left(\frac{2[|\sin x| + |\cos x|]}{\sin^2 x + 2 \sin x + \frac{11}{4}}\right)$ is defined if x belongs to (where $[.]$ represents the greatest integer function)

A. $\left[0, \frac{7\pi}{6}\right]$

B. $\left[0, \frac{\pi}{6}\right]$

C. $\left[\frac{11\pi}{6}\right]$

D. $[\pi, 2\pi]$

Answer: A::B::C



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2. Which of the following functions are defined for all x ?

A. $\sin[x] + \cos[x]$ ($[x]$ denotes the greatest integer $\leq x$)

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

C. $\tan(\log x)$

D. $\sqrt{\frac{9}{8} + \cos x + \cos 2x}$

Answer: A::B::D



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3. Which of the following functions is/are bounded?

A. $f(x) = \frac{2x}{1+x^2}, [-2, 2]$

B. $f(x) = \frac{x^2}{1-x}, x \in [0, 2] - [1]$

C. $f(x) = \frac{x^3 - 8x + 6}{4x + 1}, [0, 5]$

D. none of these

Answer: A::C



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4. The function 'g' defined by

$$g(x) = \sin\left(\sin^{-1} \sqrt{\{x\}}\right) + \cos\left(\sin^{-1} \sqrt{\{x\}}\right) - 1$$
 (where $\{x\}$ denotes the functional part function) is (1) an even function (2) a periodic function

(3) an odd function (4) neither even nor odd

(3) an odd function (4) neither even nor odd

A. an even function

B. a periodic function

C. an odd function

D. neither even nor odd

Answer: A::B



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5. Let f be a differential function such that $f(x) = f(2 - x)$ and $g(x) = f(1 + x)$ then (1) $g(x)$ is an odd function (2) $g(x)$ is an even function (3) graph of $f(x)$ is symmetrical about the line $x = 1$ (4) $f'(1) = 0$

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

B. $g(x)$ is an even function

C. graph of $f(x)$ is symmetrical about the line $x = 1$

D. $f'(1) = 0$

Answer: B::C::D



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6. If a function satisfies

$$(x - y)f(x + y) - (x + y)f(x - y) = 2(x^2y - y^3) \forall x, y \in R \text{ and } f(1) =$$

, then

A. $f(x)$ must be polynomial function

B. $f(3) = 12$

C. $f(0) = 0$

D. $f(x)$ may not be differentiable

Answer: A::B::C



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7. A function $f(x)$ is defined for all $x \in R$ and satisfies,

$$f(x + y) = f(x) + 2y^2 + kxy \forall x, y \in R, \text{ where } k \text{ is a given constant. If}$$

$f(1) = 2$ and $f(2) = 8$, find $f(x)$ and show that

$$f(x + y) \cdot f\left(\frac{1}{x + y}\right) = k, x + y \neq 0.$$

A. $f(0) = 0$

B. $f(0)$ cannot be determined

C. $k = 2$

D. k cannot be determined

Answer: A::C

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8. Suppose that $f(x)f(f(x)) = 1$ and $f(1000) = 999$ then which of the following is true

A. $f(500) = \frac{1}{500}$

B. $f(199) = \frac{1}{199}$

C. $f(x) = \frac{1}{x} \forall x \in R - \{0\}$

D. $f(1999) = \frac{1}{1999}$

Answer: A::B

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9. The graph of a function $f(x)$ which is defined in $[-1, 4]$ is shown in the adjacent figure. Identify the correct statement(s).



A. domain of $f(|x| - 1)$ is $[-5, 5]$

B. range of $f(|x| + 1)$ is $[0, 2]$

C. range of $f(-|x|)$ is $[-1, 0]$

D. domain of $f[-3, 3]$

Answer: A::B::C

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Comprehension Type

1. Let $f(x) = x^2 - 2x - 1 \forall x \in \mathbb{R}$ Let $f: (-\infty, a] \rightarrow [b, \infty)$, where a is the largest real number for which $f(x)$ is bijective. If $f: \mathbb{R} \rightarrow \mathbb{R}$, $g(x) = f(x) + 3x - 1$, then the least value of function $y = g(|x|)$ is

A. $-9/4$

B. $-5/4$

C. -2

D. -1

Answer: C



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2. Let $f(x) = x^2 - 2x - 1 \forall x \in \mathbb{R}$ Let $f: (-\infty, a] \rightarrow [b, \infty)$, where a is the largest real number for which $f(x)$ is bijective. If $f: \mathbb{R} \rightarrow \mathbb{R}$, $g(x) = f(x) + 3x - 1$, then the least value of function $y = g(|x|)$ is

A. $1 + \sqrt{x + 2}$

B. $1 - \sqrt{x + 3}$

C. $1 - \sqrt{x + 2}$

D. $1 + \sqrt{x + 3}$

Answer: A



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3. Let $f(x) = x^2 - 2x - 1 \forall x \in \mathbb{R}$. Let $f: (-\infty, a] \rightarrow [b, \infty)$, where a is the largest real number for which $f(x)$ is bijective. If $f: \mathbb{R} \rightarrow \mathbb{R}$, $g(x) = f(x) + 3x - 1$, then the least value of function $y = g(|x|)$ is

A. $(-2, -1)$

B. $(-2, 0)$

C. $(-1, 0)$

D. $(0, 1)$

Answer: A

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4. Consider a differentiable $f: \mathbb{R} \rightarrow \mathbb{R}$ for which $f(1) = 2$ and $f(x + y) = 2^x f(y) + 4^y f(x) \forall x, y \in \mathbb{R}$.

The value of $f(4)$ is

A. 160

B. 240

C. 200

D. none of these

Answer: B

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5. Consider a differentiable $f: \mathbb{R} \rightarrow \mathbb{R}$ for which $f(1) = 2$ and $f(x + y) = 2^x f(y) + 4^y f(x) \forall x, y \in \mathbb{R}$.

The minimum value of $f(x)$ is

A. 1

B. $-\frac{1}{2}$

C. $-\frac{1}{4}$

D. none of these

Answer: C



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6. Let $f(x)$ be real valued and differentiable function on R such that

$$f(x + y) = \frac{f(x) + f(y)}{1 - f(x)f(y)} f(0) \text{ is equals a. b. c. d. none of these}$$

A. 1

B. 0

C. -1

D. none of these

Answer: B



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7. Let $f(x)$ be real valued and differentiable function on R such that

$$f(x + y) = \frac{f(x) + f(y)}{1 - f(x)f(y)} f(0) \text{ is equals a. b. c. d. none of these}$$

- A. odd function
- B. even function
- C. odd and even function simultaneously
- D. neither even nor odd

Answer: A



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Single Correct Answer Type

1. $f(x) = \sin[x] + [s \text{ in } x], 0$

- A. $\begin{cases} 0, & 0 < x < 1 \\ 1 + \sin 1, & 1 \leq x < \frac{\pi}{4} \end{cases}$
- B. $\begin{cases} \frac{1}{\sqrt{2}}, & 0 < x < \frac{\pi}{4} \\ 1 + \frac{1}{2} + \frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{2}, & \frac{\pi}{4} \leq x < \frac{\pi}{2} \end{cases}$
- C. $\begin{cases} 0, & 0 < x < 1 \\ \sin 1, & 1 \leq x < \frac{\pi}{2} \end{cases}$
- D. $\begin{cases} 0, & 0 < x < \frac{\pi}{4} \\ 1, & \frac{\pi}{4} < x < 1 \\ \sin 1, & 1 \leq x \leq \frac{\pi}{4} \end{cases}$

Answer: C



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2. If $\phi(x) = \frac{1}{1 + e^{-x}}$ and $S = \phi(5) + \phi(4) + \phi(3) + \dots + \phi(-3) + \phi(-4) + \phi(-5)$ then the value of S is

- A. 5
- B. $11/2$
- C. 6

D. 13/2

Answer: B



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3. For non-negative integers m and n a function is defined as follows

$f(m,n) = \{n+1 \text{ if } m=0; f(m-1,1) \text{ if } m \neq 0, n=0\}$ Then the value of $f(1,1)$ is

A. 1

B. 2

C. 3

D. 4

Answer: C



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4. If $f: R \rightarrow Q$ (Rational numbers), $g: R \rightarrow Q$ (Rational numbers) are two continuous functions such that $\sqrt{3}f(x) + g(x) = 4$ then $(1 - f(x))^3 + (g(x) - 3)^3$ is equal to (1) 1 (2) 2 (3) 3 (4) 4

A. 1

B. 2

C. 3

D. 4

Answer: B



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5. If f and g are two functions defined on N , such that $f(n) = \begin{cases} 2n - 1 & \text{if } n \text{ is even} \\ 2n + 2 & \text{if } n \text{ is odd} \end{cases}$ and $g(n) = f(n) + f(n + 1)$. Then range of g is $\{m \in N : m = \text{multiple of } 4\}$ $\{\text{set of even natural numbers}\}$ $\{m \in N : m = 4k + 3, k \text{ is a natural number}\}$ $\{m \in N : m = \text{multiple of } 3 \text{ or multiple of } 4\}$

A. $\{m \in \mathbb{N} : m = \text{multiple of } 4\}$

B. $\{\text{set of even natural numbers}\}$

C. $\{m \in \mathbb{N} : m = 4k + 3, k \text{ is a natural number}\}$

D. $\{m \in \mathbb{N} : m = \text{multiple of } 3 \text{ or multiple of } 4\}$

Answer: C



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6. The number of points on the real line where the function $f(x) = \log_{|x^2 - 1|} |x - 3|$ is not defined is

$f(x) = \log_{|x^2 - 1|} |x - 3|$ is not defined is

A. 4

B. 5

C. 6

D. 7

Answer: C

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7. For relation $2 \log y - \log x - \log(y - 1) = 0$

A. domain = $(4, +\infty)$, range = $(1 + \infty)$

B. domain = $(4, \infty)$, range = $(2 + \infty)$

C. domain = $(2, \infty)$, range = $(2, +\infty)$

D. none of these

Answer: A

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8. The range of the function $y = [x^2] - [x]^2$ $x \in [0, 2]$ (where $[\]$ denotes the greatest integer function), is

A. $[0]$

B. $[0,1]$

C. [1,2]

D. [0,1,2]

Answer: D



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9. The number of elements in the domain of the function

$$f(x) = \sin^{-1}\left(\frac{x^2 - 2x}{3}\right) + \sqrt{([x] + [-x])}, \text{ (where } [.] \text{ denotes the}$$

greater integer function) is equal to a. 4 b. 6 c. 3 d. 5

A. 6

B. 4

C. 3

D. 5

Answer: D



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10. Range of the function

$$f(x) = \sqrt{\cos^{-1}\left(\sqrt{\log_4 x}\right) - \frac{\pi}{2}} + \sin^{-1}\left(\frac{1+x^2}{4x}\right) \text{ is equal to}$$

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

D. $\left\{\frac{\pi}{6}\right\}$

Answer: D



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11. The range of the function $f(x) = \tan^{-1}\left(\frac{x^2+1}{x^2+\sqrt{3}}\right)$ $x \in R$ is

A. $\left[\frac{\pi}{6}, \frac{\pi}{2}\right)$

B. $\left[\frac{\pi}{6}, \frac{\pi}{3}\right)$

C. $\left[\frac{\pi}{6}, \frac{\pi}{4}\right)$

D. none of these

Answer: C



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12. The domain of the function $f(x) = \sqrt{10 - \sqrt{x^4 - 21x^2}}$ is $[5, \infty)$ b.

$[-\sqrt{21}, \sqrt{21}]$ c. $[-5, -\sqrt{21}] \cup [\sqrt{21}, 5] \cup \{0\}$ d. $(-\infty, -5)$

A. $[5, \infty]$

B. $[-\sqrt{21}, \sqrt{21}]$

C. $[-5 - \sqrt{21}] \cup [\sqrt{21}, 5] \cup \{0\}$

D. $(-\infty, -5)$

Answer: C



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13. Number of integers in domain of function

$$f(x) = \log_{|x^2|}(4 - |x|) + \log_2\{\sqrt{x}\}$$

A. 0

B. 1

C. 2

D. 3

Answer: C



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14. The domain of the function

$$f(x) = \log_e\{sgn(9 - x^2)\} + \sqrt{[x]^3 - 4[x]}$$

(where $[]$ represents the

greatest integer function is

A. $[-2, 1) \cup [2, 3)$

B. $[-4, 1) \cup [2, 3)$

C. $94, 1) \cup [2, 3)$

D. $[2, 1) \cup [2, 3)$

Answer: A



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15. Number of integers in the integer of

$$f(x) = \frac{1}{\pi} (\sin^{-1} x + \tan^{-1} x) + \frac{x+1}{x^2+2x+5} \text{ is 0 b. 3 c. 2 d. 1}$$

A. 0

B. 3

C. 2

D. 1

Answer: C



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16. Let $G(x) = \left(\frac{1}{a^x - 1} + \frac{1}{2} \right) F(x)$, where a is a positive real number not equal to 1 and $f(x)$ is an odd function. Which of the following statements is true? $G(x)$ is an odd function $G(x)$ is an even function $G(x)$ is neither even nor odd function. Whether $G(x)$ is an odd or even function depends on the value of a

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

B. $G(x)$ is an even function

C. $G(x)$ is neither even function nor odd function

D. Whether $G(x)$ is an odd function or an even function, it depends on the value of a

Answer: B

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17.

Let

$$f(x) = \left([a]^2 - 5[a] + 4 \right) x^3 - \left(6\{a\}^2 - 5\{a\} + 1 \right) x - (\tan x) x \operatorname{sgn} x$$

be an even function for all $x \in R$. Then the sum of all possible values of a is (where $[.]$ and $\{.\}$ denote greatest integer function and fractional part function, respectively). $\frac{17}{6}$ (b) $\frac{53}{6}$ (c) $\frac{31}{3}$ (d) $\frac{35}{3}$

A. $\frac{17}{6}$

B. $\frac{53}{6}$

C. $\frac{31}{3}$

D. $\frac{35}{3}$

Answer: D



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18. $f(x) = \sin^2 x + \cos^4 x + 2$ and $g(x) = \cos(\cos x) + \cos(\sin x)$ Also let period $f(x)$ and $g(x)$ be T_1 and T_2 respectively then

A. $T_1 = 2T_2$

B. $2T_1 = T_2$

C. $T_1 = T_2$

D. $T_1 = 4T_2$

Answer: C



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19. A continuous, even periodic function f with period 8 is such that $f(0) = 0, f(1) = -2, f(2) = 1, f(3) = 2, f(4) = 3$, then the value of $\tan^{-1} \tan\{f(-5) + f(20) + \cos^{-1}(f(-10)) + f(17)\}$ is equal to

A. $2\pi - 3$

B. $3 - 2\pi$

C. $2\pi + 3$

D. $3 - \pi$

Answer: D



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20. If a and b are natural numbers and

$f(x) = \sin\left(\sqrt{a^2 - 3}\right)x + \cos\left(\sqrt{b^2 + 7}\right)x$ is periodic with finite

fundamental period then period of $f(x)$ is

A. π

B. 2π

C. $2\pi\left(\sqrt{a^2 - 3} + \sqrt{b^2 + 7}\right)$

D. $\pi\left(\sqrt{a^2 - 3} + \sqrt{b^2 + 7}\right)$

Answer: B



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

A. $1/6$

B. $2/3$

C. $5/6$

D. $1/3$

Answer: D



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22. What is the fundamental period of $f(x) = \frac{\sin x + \sin 3x}{\cos x + \cos 3x}$

A. $\pi/2$

B. π

C. 2π

D. 3π

Answer: B



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23. If $f: R \rightarrow R$ is a function satisfying the property $f(x + 1) + f(x + 3) = 2$ for all $x \in R$ then f is

- A. periodic with period 3
- B. periodic with period 4
- C. non periodic
- D. periodic with period 5

Answer: B



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24. Period of $f(x) = \text{sgn}([x] + [-x])$ is equal to (where $[.]$ denotes greatest integer function)

- A. 1
- B. 2
- C. 3

D. does not exist

Answer: A



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25. If $F(x)$ and $G(x)$ are even and odd extensions of the functions $f(x) = x|x| + \sin|x| + xe^x$, where $x \in (0, 1)$, $g(x) = \cos|x| + x^2 - x$, is where $x \in (0, 1)$ respectively to the interval $(-1, 0)$ then $F(x) + G(x)$ in $(-1, 0)$ is

A. $\sin x + \cos x + xe^{-x}$

B. $-(\sin x + \cos x + xe^{-x})$

C. $-(\sin x + \cos x + x + xe^{-x})$

D. $-(\sin x + \cos x + x^2 + xe^{-x})$

Answer: C



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26. Let $P(x) = x^{10} + a_2x^8 + a_3x^6 + a_4x^4 + a_5x^2$ be a polynomial with real coefficients. If $P(1)$ and $P(2) = 5$, then the minimum-number of distinct real zeroes of $P(x)$ is

A. 5

B. 6

C. 7

D. 8

Answer: A



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27. Let $f: R \rightarrow [1, \infty)$ be defined as

$f(x) = \log_{10} \left(\sqrt{3x^2 - 4x + k + 1} + 10 \right)$ If $f(x)$ is surjective then $k =$

A. $k = \frac{1}{3}$

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

C. $l > \frac{1}{3}$

D. $k = 1$

Answer: A

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28. Let $f: [-\infty, 0] \rightarrow [1, \infty)$ be defined as

$$f(x) = (1 + \sqrt{-x}) - (\sqrt{-x} - x), \text{ then}$$

- A. injective but not surjective
- B. injective as well as surjective
- C. neither injective nor surjective
- D. surjective but injective

Answer: B

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29. Let A be a non-empty set of real numbers and $f: A \rightarrow A$ be such that $f(f(x)) = x \forall x \in R$ then $f(x)$ is (A) bijection (B) one-one but not onto (C) onto but not one-one (D) neither one-one nor onto

- A. a bijection
- B. one-one but not onto
- C. onto but not one-one
- D. neither one-one nor onto

Answer: A



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30. $f: R \rightarrow R$ defined by $f(x) = \frac{1}{2}x|x| + \cos x + 1$ is

- A. one-one and onto
- B. one-one and into
- C. many-one and onto

D. many-one and into

Answer: A

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31. Let $f(x): R \rightarrow R, f(x) = \begin{cases} 2x + \alpha^2 & x \geq 2 \\ \frac{\alpha x}{2} + 10 & x < 2 \end{cases}$ If $f(x)$ is onto function then α belongs to (A) $[1, 4]$ (B) $[-2, 3]$ (C) $[0, 3]$ (D) $[2, 5]$

A. $[1, 4]$

B. $[-2, 3]$

C. $(0, 3]$

D. $[2, 5]$

Answer: C

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32. Let $f: R \rightarrow \left(0, \frac{2\pi}{2}\right]$ defined as $f(x) = \cot^{-1}(x^2 - 4x + \alpha)$ Then the smallest integral value of α such that, $f(x)$ is into function is

A. 2

B. 4

C. 6

D. 8

Answer: B



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33. Let $f: R^+ \rightarrow \{-1, 0, 1\}$ defined by $f(x) = \text{sgn}(x - x^4 + x^7 - x^8 - 1)$ where sgn denotes signum function then $f(x)$ is (1) many- one and onto (2) many-one and into (3) one-one and onto (4) one- one and into

A. many-one and onto

B. many-one and into

C. one-one and onto

D. one-one and into

Answer: B



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34. Which of the following statements are incorrect? If $f(x)$ and $g(x)$ are one-one then $f(x) + g(x)$ is also one-one If $f(x)$ and $g(x)$ are one-one then $f(x)g(x)$ is also one-one If $f(x)$ is odd then it is necessarily one-one? *I and II only* b. *II and III only* c. *III and I only* d. *I, II and III*

A. I and II only

B. II and III only

C. III and I only

D. I, II and III

Answer: D



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35. Which of the following functions is one-one ? (1) $f: R \rightarrow R$ defined as

$f(x) = e^{\operatorname{sgn} x} + e^{x^2}$ (2) $f: [-1, \infty) \rightarrow (0, \infty)$ defined by

$f(x) = e^{x^2 + |x|}$ (3) $f: [3, 4] \rightarrow [4, 6]$ defined by

$f(x) = |x - 1| + |x - 2| + |x - 3| + x - 4|$

(4) $f(x) = \sqrt{\ln(\cos(\sin x))}$

A. $f: R \rightarrow R$ defined as $f(x) = d^{\operatorname{sgn} x} + d^{x^2}$

B. $f: [-1, \infty) \rightarrow (0, \infty)$ defined by $f(x) = e^{x^2 + |x|}$

C.

$f: [3, 4] \rightarrow [4, 6]$ defined by $f(x) = |x - 1| + |x - 2| + |x - 3| + |$

D. $f(x) = \sqrt{\ln(\cos(\sin x))}$

Answer: C



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36. If $g(x) = \left(4 \cos^4 x - 2 \cos 2x - \frac{1}{2} \cos 4x - x^7\right)^{\frac{1}{7}}$ then the value of $g(g(100))$ is equal to

A. -1

B. 0

C. 1

D. 100

Answer: D



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37. If $f(x) = x^2 + x + \frac{3}{4}$ and $g(x) = x^2 + ax + 1$ be two real functions, then the range of a for which $g(f(x)) = 0$ has no real solution is $(-\infty, -2)$ b. $(-2, 2)$ c. $(-2, \infty)$ d. $(2, \infty)$

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

B. $(-2, 2)$

C. $(-2, \infty)$

D. $(2, \infty)$

Answer: C

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38. If domain of $f(x)$ is $[1, 3]$, then the domain of $f(\log_2(x^2 + 3x - 2))$ is

A. $[-5, -4] \cup [1, 2]$

B. $[-13, -2] \cup \left[\frac{3}{5}, 5\right]$

C. $[4, 1] \cup [2, 7]$

D. $[-3, 2]$

Answer: A

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39. Let $f(x) = \frac{x}{1+x}$ and let $g(x) = \frac{rx}{1-x}$, Let S be the set off all real numbers r such that $f(g(x)) = g(f(x))$ for infinitely many real number x. The number of elements in set S is

- A. 1
- B. 2
- C. 3
- D. 5

Answer: B



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40. 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. $a = b = 1$

D. $a = b = c = d = 1,$

Answer: A



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41. If $f: R \rightarrow R$, $f(x) = x^3 + 3$, and $g: R \rightarrow R, g(x) = 2x + 1$, then $f^{-1} \circ g^{-1}(23)$ equals

A. 2

B. 3

C. $(14)^{1/3}$

D. $(15)^{1/3}$

Answer: A



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42. If $f(x) = x(x - 1)$ is a function from $\left[\frac{1}{2}, \infty\right) \rightarrow \left[-\frac{1}{4}, \infty\right)$, then $\{x \in \mathbb{R} : f^{-1}(x) = f(x)\}$ is a. null set b. $\{0, 2\}$ c. $\{2\}$ d. a set containing 3 elements

A. null set

B. $\{0, 2\}$

C. $\{2\}$

D. a set containing 3 elements

Answer: C



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43. Let $a > 1$ be a real number and $f(x) = \log_a x^2$ for $x > 0$. If f^{-1} is the inverse function of f and b and c are real numbers then $f^{-1}(b + c)$ is equal to

A. $f^{-1}(b) \cdot f^{-1}(c)$

B. $f^{-1}(b) + f^{-1}(c)$

C. $\frac{1}{f(b+c)}$

D. $\frac{1}{f^{-1}(b) + f^{-1}(c)}$

Answer: A



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44. If the function $f(x) = \begin{cases} x + 1 & \text{if } x \leq 1, \\ 2x + 1 & \text{if } 1 < x \leq 2 \end{cases}$ and $g(x) = \begin{cases} x^2, & -1 \leq x \leq 2 \\ 2x + 2 & 2 \leq x \leq 3 \end{cases}$ then the number of roots of the equation $f(g(x)) = 2$

A. 4

B. 3

C. 2

D. 1

Answer: C



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45. Suppose $f(x) = ax + b$ and $g(x) = bx + a$, where a and b are positive integers. If $f(g(20)) - g(f(20)) = 28$, then which of the following is not true? a. $a = 15$ b. $a = 6$ c. $b = 14$ d. $b = 3$

A. $a = 15$

B. $a = 6$

C. $b = 14$

D. $b = 3$

Answer: D



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46. If $f(x)$ is an invertible function and $g(x) = 2f(x) + 5$, then the value of $g^{-1}(x)$ is $2f^{-1}(x) - 5$ (b) $\frac{1}{2f^{-1}(x) + 5}$ $\frac{1}{2}f^{-1}(x) + 5$ (d) $f^{-1}\left(\frac{x - 5}{2}\right)$

A. $2f^{-1}(x) - 5$

B. $\frac{1}{2f^{-1}(x) + 5}$

C. $\frac{1}{2}f^{-1}(x) + 5$

D. $f^{-1}\left(\frac{x - 5}{2}\right)$

Answer: D



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47. If $f(x) = \begin{cases} -x + 1, & x \leq 0 \\ -(x - 1)^2, & x \geq 1 \end{cases}$, then the number of solutions of

$f(x) - f^{-1}(x) = 0$ is

A. 0

B. 2

C. 3

D. 4

Answer: D



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48. Let $f\left(x + \frac{1}{y}\right) + f\left(x - \frac{1}{y}\right) = 2f(x)f\left(\frac{1}{y}\right) \forall x, y \in R, y \neq 0$ and $f(0)=0$ then the value of $f(1) + f(2) =$

A. -1

B. 0

C. 1

D. none of these

Answer: B



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49. If $f(x^2 - 6x + 6) + f(x^2 - 4x + 4) = 2x \forall x \in R$ then $f(-3) + f(9) - 5f(1) =$ (A) 7 (B) 8 (C) 9 (D) 10

A. 7

B. 8

C. 9

D. 10

Answer: C



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50. If a function $f: R \rightarrow R$ be such that

$$f(x - f(y)) = f(f(y)) + xf(y) + f(x) - 1 \forall x, y \in R \text{ then } f(2) =$$

A. 1

B. 3

C. -1

D. none of these

Answer: C



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51. If $f: \overrightarrow{RR}$ is a function satisfying $f(x + y) = f(xy)$ for all $x, y \in R$ and $f\left(\frac{3}{4}\right) = \frac{3}{4}$, then $f\left(\frac{9}{16}\right) = \frac{3}{4}$ b. $\frac{9}{16}$ c. $\frac{\sqrt{3}}{2}$ d. 0

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

B. $\frac{9}{16}$

C. $\frac{\sqrt{3}}{2}$

D. 0

Answer: A



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52. A function $f: R \rightarrow R$ satisfy the equation $f(x)f(y) - f(xy) = x + y$ for all $x, y \in R$ and $f(y) > 0$, then

A. $f(x)f^{-1}(x) = x^2 - 4$

B. $f(x)f^{-1}(x) = x^2 - 6$

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

D. none of these

Answer: C



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53. Let f be a function defined from $F^+ \rightarrow R^+$. If $(f(xy))^2 = x(f(y))^2$ for all positive numbers x and y , If $f(2) = 6$, find $f(50)=?$

A. 20

B. 30

C. 5

D. 40

Answer: B



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54. Suppose f is a real function satisfying

$f(x + f(x)) = 4f(x)$ and $f(1) = 4$. Then the value of $f(21)$ is

105

A. 16

B. 64

C. 4

D. 44

Answer: B



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55. The graph of a function $y = g(x)$ is shown in the following figure. If

$f(x) = -3x^2 - kx - 12$, $k \in R$ and $f(g(x)) > 0 \forall x \in R$ then test

least integral value of k is equal to



A. 13

B. 14

C. 15

D. 16

Answer: C



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56. Let $f: I \rightarrow I$ be a function (I is set of integers) such that $f(0) = 1$, $f(f(n)) = f(f(n+2) + 2) = n$. then $f(3) = 0$ b. $f(2) = 0$ c. $f(3) = -2$ d. f is many one function

A. $f(3) = 0$

B. $f(2) = 0$

C. $f(3) = -2$

D. f is many -one function

Answer: C



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Question Bank

1. If $f(x) = 2x - 1$ then number of solution (s) of the equation $|f(x)| = |f(|x| - 1)|$ is (are)



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2. If there are four distinct real numbers satisfying the equation $|x^2 - 4x - 7| = n$, then number of integers in the range of n is



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3. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a polynomial function satisfying $f(f(x) - 2y) = 2x - 3y + f(f(y) - x)$, $\forall x, y \in \mathbb{R}$ then the value of

$f(20) - f(14)$ is equal to

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4. The least integral value in the range of

$f(x) = e^{2x + \frac{1}{1+e^{2x}}}$ is

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5. Let $P(x) = x^4 + ax^3 + bx^2 + cx + d$ be a polynomial such that $P(1) = 1, P(2) = 8, P(3) = 27, P(4) = 64$ then find $P(10)$

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6. Given $f(x)$ is a polynomial function of x , satisfying $f(x) \cdot f(y) = f(x) + f(y) + f(xy) - 2$ and that $f(2) = 5$. Then $f(3)$ is equal to

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7. A function $f(x)$ is such that $f(x) = 0$ has 8 distinct real roots and $f(x) = f(6 - x)$ for $x \in R$. Sum of real roots of the equation $f(x) = 0$ is

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8. Let:
 $f: \{x_1, x_2, x_3\} \rightarrow \{1, 2, 3, 4, \dots, 13\}$ be a function, The number of functions f such that $f(x_{i+1}) - f(x_i) = 2f$ or $i=1, 2$ is

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9. The number of integral values of x satisfying the equation $sgn\left(\left[\frac{15}{1+x^2}\right]\right) = [1+2x]$ is [Note: $sgn(y)$, $[y]$ and y denote signum function, greatest integer function and fractional part function respectively.]

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10. Let $f(x) = \frac{1 - cx}{1 - c^2}$. If $f(x) > 0$ for every x greater than zero. Then the number of integers in the range of c is

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11. Let $f: [0, \infty) \rightarrow [0, \infty)$ be a function defined by $f(x) = x^2 + (k^2 - 3k + 2)x + k^2 - k$. If $f(x)$ is both injective and surjective, then the number of integers in the range of k is

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12. Let $g: [-2, 2] \rightarrow R$, where $g(x) = x^{2015} + \operatorname{sgn}(x) + \left[\frac{x^2 + 1}{p} \right]$ be an odd function for all $x \in [-2, 2]$ then the smallest integral value of p is equal to [Note: $[k]$ denote the greatest integer less than or equal to k .]

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13. Let the function $f: R \rightarrow R$ be defined as $f(x) = \min . (x + 2, 4 - 2x, 1 + 4x)$. The maximum value of $f(x)$ is equal to



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14. Let $f: R \rightarrow R$ be defined as $f(x) = 2x^3 + 7x - 5$ and $g(x) = f^{-1}(x)$. If $g'(4) = \frac{a}{b}$ where a and b are relatively prime positive integers then $(a + b)$ is equal to



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15. Let $f: R \rightarrow R$ be defined as $f(x) = \begin{cases} 2x + 3 & x \leq 1 \\ p^2x + 1 & x > 1 \end{cases}$. If $f(x)$ is onto function then number of integral values of p is equal to



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16. Let $g: R \rightarrow \left\{ \frac{3}{2} \right\} \rightarrow R - \left\{ \frac{3}{2} \right\}$ be defined as $g(x) = \frac{3x + 5}{2x - 3}$. If $g_{2014}(x) = \frac{px - q}{-rx + s}$

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17. If $f(x) = 3\sqrt{\frac{9}{\log_2(3 - 2x) - 1}}$ then the value of ' a ' which satisfies $f^{-1}(2a - 4) = \frac{1}{2}$, is

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18. Let $f: R \rightarrow R$ defined by $f(x) = 100^{\text{sgn}(x)} + e^{|x|}$, where $\text{sgn}(x)$ denotes signum function of x , and $f(x) = k$ has 2 distinct solution, then minimum integral value of k is

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19. Consider the function $f(x) = \sqrt{2-x} + \sqrt{1+x}$. If d denotes the number of integers in the domain of f and ' r ' denotes the number of integers in the range of f , then $(d + r)$ equals



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20. If $f(x, y) = (\max(x, y))^{\min(x, y)}$ and $g(x, y) = \max(x, y) - \min(x, y)$, then $f\left(g\left(-1, \frac{-3}{2}\right), g(-4, -1.75)\right)$ equals



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21. The number of solution of the equation $e^{2x} \div e^x + e^{-(2x)} + e^{-x} = 3(e^{-2x} \div e^x)$ is



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22. If $f(x) = px + q$ and $f(f(f(x))) = 8x + 21$, where p and q are real numbers, then $p + q$ equals

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23. Suppose $f(x) = ax + b$ and $g(x) = bx + a$, where a and b are positive integers. If $f(g(50)) - g(f(50)) = 28$ then find the sum of all possible values of a is equal to

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24. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function such that $f(x) = 19$ $\forall x \in \mathbb{Q}$ and $g(x) = \sqrt{39 + x^2}$, then the value of $g(f(x))$ is

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25. Let the equation $(a - 1)x^2 = x(2b + 3)$ be satisfied by three distinct values of x , where $a, b \in R$, if $f(x) = (a - 1)x^3 + (2b + 3)x^2 + 2x + 1$, and $f(g(x)) = 6x - 7$ where $g(x)$ is a linear function then find the value of $g'(2012)$.

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26. Let $f(x) = [2x^2 - 10x, -\infty < x < 5], [x^2 - 5, -5 < x < 3], [x^2 + 1, 3 < x < \infty]$

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27. Let $f(x) = \frac{x}{1-x}$ and 'a' be a real number. If $x_0 = a$, $x_1 = f(x_0)$, $x_2 = f(x_1)$, $x_3 = f(x_2)$ and so on. If $x_{2009} = 1$, then the value of reciprocal of 'a' is

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28. The function $f(x) = \frac{3x - 2}{x + 4}$ has an inverse that can be written in the form $f^{-1}(x) = \frac{x + b}{cx + d}$. The value of $(b + c + d)$ equals

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29. If the largest positive value of the function defined as $f(x) = \sqrt{8x - x^2} - \sqrt{14x - x^2 - 48}$, is $m\sqrt{n}$ where $m, n \in \mathbb{N}$, the find least value of $(m + n)$

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30. If range of the function $f(x) = \sin^{-1} x + 2 \tan^{-1} x + x^2 + 4x + 1$ is $[p, q]$ then find the value of $(p + q)$.

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