1. If the function $f(x) = 2x^2 - kx + 5$ is increasing in $[1, 2]$, then 'k' lies in the interval

(A) $(-\infty, 4)$ (B) $(4, \infty)$ (C) $(-\infty, 8]$ (D) $(8, \infty)$

2. $f(x) = x + 1/x, x \neq 0$ is monotonic increasing when-

(A) $|x| < 1$ (B) $|x| > 1$ (C) $|x| < 2$ (D) $|x| > 2$

3. The function x^x decreases on the interval-

(A) $(0, e)$ (B) $(0, 1)$ (C) $\left(0, \frac{1}{e}\right)$ (D) None of these

4. Function $f(x) = x^2(x-2)^2$ is-

(A) increasing in $(0, 1) \cup (2, \infty)$ (B) decreasing in $(0, 1) \cup (2, \infty)$

(C) decreasing function (D) increasing function

5. If f and g are two decreasing function such that fog is defined, then fog will be-

(A) increasing function (B) decreasing function

(C) neither increasing nor decreasing (D) None of these

6. If function $f(x) = 2x^2 + 3x - m\log x$ is monotonic decreasing in the interval $(0, 1)$, then the least value of the parameter m is-

(A) 7 (B) $\frac{15}{2}$ (C) $\frac{31}{4}$ (D) 8

7. If $f(x) = x^3 - 10x^2 + 200x - 10$, then f(x) is-

(A) decreasing in $(-\infty, 10]$ and increasing in $(10, \infty)$

(B) increasing in $(-\infty, 10]$ and decreasing in $(10, \infty)$

(C) increasing for every value of x

(D) decreasing for every value of x

8. Which one of the following statements does not hold good for the function $f(x) = \cos^{-1}(2x^2 - 1)$?

(A) f is not differentiable at $x = 0$ (B) f is monotonic

(C) f is even (D) f has an extremum

9. Number of critical points of the function, $f(x) = \frac{2}{3}\sqrt{x^3} - \frac{x}{2} + \int_1^x \left(\frac{1}{2} + \frac{1}{2}\cos 2t - \sqrt{t}\right)dt$ which lie in the interval $[-2\pi, 2\pi]$ is :

(A) 2 (B) 4 (C) 6 (D) 8

10. The value of K in order that $f(x) = \sin x - \cos x - Kx + b$ decreases for all real values is given by-

(A) $K < 1$ (B) $K \geq 1$ (C) $K \geq \sqrt{2}$ (D) $K < \sqrt{2}$

11. When $0 \le x \le 1$, $f(x) = |x| + |x-1|$ is-

(A) increasing (B) decreasing (C) constant (D) None of these

12. Let f (x) and g (x) be two continuous functions defined from $R \to R$, such that $f(x_1) > f(x_2)$ and $g(x_1) < g(x_2)$, $\forall\ x_1 > x_2$, then solution set of $f\left(g(\alpha^2 - 2\alpha)\right) > f\left(g(3\alpha - 4)\right)$ is

(A) R (B) ϕ (C) (1, 4) (D) R – [1, 4]

13. If $2a + 3b + 6c = 0$, then at least one root of the equation $ax^2 + bx + c = 0$ lies in the interval-

(A) (0, 1) (B) (1, 2) (C) (2, 3) (D) none

14. If the equation $a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x = 0$ has a positive root $x = \alpha$, then the equation $na_n x^{n-1} + (n-1)\, a_{n-1} x^{n-2} + \dots + a_1 = 0$ has a positive root, which is-

(A) Smaller than α (B) Greater than α

(C) Equal to α (D) Greater than or equal to α

15. A value of C for which the conclusion of Mean values theorem holds for the function $f(x) = \log_e x$ on the interval [1, 3] is-

(A) $2\log_3 e$ (B) $\frac{1}{2}\log_e 3$ (C) $\log_3 e$ (D) $\log_e 3$

16. The value of c in Lagrange's theorem for the function $f(x) = \begin{cases} x\cos\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$ in the interval [–1, 1] is-

(A) 0 (B) $\frac{1}{2}$

(C) $-\frac{1}{2}$ (D) Non existent in the interval

17. If the function $f(x) = x^3 - 6x^2 + ax + b$ defined on [1, 3], satisfies the rolle's theorem for $c = \frac{2\sqrt{3}+1}{\sqrt{3}}$, then-

(A) a = 11, b = 6 (B) a = –11, b = 6 (C) a = 11, $b \in R$ (D) None of these

18. Given: $f(x) = 4 - \left(\frac{1}{2} - x\right)^{2/3}$ $g(x) = \begin{cases} \frac{\tan [x]}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$

$h(x) = \{x\}$ $k(x) = 5^{\log_2 (x+3)}$

then in [0, 1], Lagranges Mean Value Theorem is NOT applicable to

(A) f, g, h (B) h, k (C) f, g (D) g, h, k

where [x] and {x} denotes the greatest integer and fractional part function.

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

(A) $a \ge 1$ (B) $a \ge 0$ (C) $a \le 0$ (D) $a \le 1$

20. The function $f(x)=\tan^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ is -
(A) increasing in its domain
(B) decreasing in its domain
(C) decreasing in $(-\infty, 0)$ and increasing in $(0, \infty)$
(D) increasing in $(-\infty, 0)$ and decreasing in $(0, \infty)$

21. Given $f'(1)=1$ and $\frac{d}{dx}(f(2x))=f'(x)\ \forall x>0$. If $f'(x)$ is differentiable then there exists a number $c \in (2, 4)$ such that $f''(c)$ equals
(A) – 1/4
(B) – 1/8
(C) 1/4
(D) 1/8

22. **Statement 1 :** The function $x^2(e^x+e^{-x})$ is increasing for all $x>0$. [JEE-MAIN Online 2013]
Statement 2 : The functions x^2e^x and x^2e^{-x} are increasing for all $x>0$ and the sum of two increasing functions in any interval (a, b) is an increasing function in (a, b).
(A) Statement 1 is false; Statement 2 is true.
(B) Statement 1 is true; Statement 2 is false.
(C) Statement 1 is true; Statement 2 is true; Statement 2 is a correct explanation for Statement 1.
(D) Statement 1 is true ; Statement 2 is true; Statement 2 is not a correct explanation for Statement 1.

23. Let f (x) and g (x) are two function which are defined and differentiable for all $x \geq x_0$. If $f(x_0)=g(x_0)$ and $f'(x)>g'(x)$ for all $x>x_0$ then
(A) $f(x)<g(x)$ for some $x>x_0$
(B) $f(x)=g(x)$ for some $x>x_0$
(C) $f(x)>g(x)$ only for some $x>x_0$
(D) $f(x)>g(x)$ for all $x>x_0$

24. The set of value(s) of 'a' for which the function $f(x)=\frac{ax^3}{3}+(a+2)x^2+(a-1)x+2$ posses a negative point of inflection.
(A) $(-\infty,-2)\cup(0,\infty)$
(B) $\{-4/5\}$
(C) $(-2, 0)$
(D) empty set

25. If the function $f(x)=2x^2+3x+5$ satisfies LMVT at $x=2$ on the closed interval [1, a], then the value of 'a' is equal to
(A) 3
(B) 4
(C) 6
(D) 1

EXERCISE (O-2)

[SINGLE CORRECT CHOICE TYPE]

1. The equation $\sin x + x\cos x = 0$ has at least one root in
(A) $\left(-\frac{\pi}{2}, 0\right)$
(B) $(0, \pi)$
(C) $\left(\pi, \frac{3\pi}{2}\right)$
(D) $\left(0, \frac{\pi}{2}\right)$

2. The number of roots of the equation $x^2-2x-\log_2|1-x|=3$ is
(A) 4
(B) 2
(C) 1
(D) 0

3. If $f: R \to R^+$ be a differentiable function and $g(x)=e^{2x}(2f(x)-3(f(x))^2+2(f(x))^3)\ \forall x \in R$, then which of the following is/are always correct -
(A) g(x) is increasing wherever $f(x)$ is increasing
(B) g(x) is increasing wherever $f(x)$ is decreasing
(C) g(x) is decreasing wherever $f(x)$ is decreasing
(D) g(x) is decreasing wherever $f(x)$ is increasing