CBSE

APPLICATION OF DERIVATIVES WS 1

Class 12 - Mathematics

1. Find the angle of intersection of the two curves $x^2y = 2$ and $xy^2 = 4$ **[1]**

a) $\tan^{-1} 3$

b) $\tan^{1} \frac{3}{5}$

c) $\tan^{-1} \frac{5}{3}$

d) $\tan^{-1} \frac{3}{5}$

2. The maximum value of slope of the curve $y = -x^3 + 3x^2 + 12x - 5$ is: **[1]**

a) 9

b) 15

c) 0

d) 12

3. Find the intervals in which $f(x) = - x^2 - 2x + 15$ is increasing or decreasing **[1]**

a) Decreasing$(-\infty, -4)$
Increasing $(-4, \infty)$

b) Increasing $(\infty, -2)$
Decreasing $(0, \infty)$

c) Increasing $(-\infty, -1)$
Decreasing $(-1, \infty)$

d) Increasing $(-\infty, -4)$
Decreasing $(-4, \infty)$

4. The function $f(x) = \cos x -2 \lambda x$ is monotonic decreasing when **[1]**

a) $\lambda > 2$

b) $\lambda < 1/2$

c) $\lambda > 1/2$

d) $\lambda < 2$

5. The function $f(x) = x^2e^{-x}$ is Monotonic increasing when **[1]**

a) $x \in R - [0, 2]$

b) $0 < X < 2$

c) $2 < X < \infty$

d) $X < 0$

6. $f(x) = \sin x - kx$ is decreasing for all $x \in R$, when **[1]**

a) $k \geq 1$

b) $k < 1$

c) $k > 1$

d) $k \leq 1$

7. If $xy = a^2$ and $S = b^2x + c^2y$ where a, b and c are positive constants then the minimum value of S is **[1]**

a) 2abc

b) $bc\sqrt{a}$

c) 2abc

d) abc

8. The function $f(x) = \frac{\lambda \sin x+2 \cos x}{\sin x+\cos x}$ is increasing, if, **[1]**

a) $\lambda > 1$

b) $\lambda > 2$

c) $\lambda < 2$

d) $\lambda < 1$

9. Function $f(x) = \log_a x$ is increasing on R , if **[1]**

a) $a < 1$

b) $0 < a < 1$

c) a > 1 | d) a > 0

10. The minimum value of the function f(x) = $2x^3 - 21x^2 + 36x - 20$ is **[1]**

a) -128 | b) -120

c) -126 | d) -124

11. If x is real, the minimum value of $x^2 - 8x + 17$ is **[1]**

a) 2 | b) 0

c) – 1 | d) 1

12. The critical points for the function f(x) = $x^3 - 2x^2 + x + 1$ are **[1]**

a) 1, 0 | b) 4, 3

c) 2, 1 | d) $1, \frac{1}{3}$

13. f(x) = $(x + 1)^3 (x - 3)^3$ is increasing in **[1]**

a) $(1, \infty)$ | b) (-1, 3)

c) $(-\infty, 1)$ | d) $(3, \infty)$

14. The function f(x) = $\frac{x}{1+|x|}$ is **[1]**

a) strictly increasing | b) strictly decreasing

c) either increasing or decreasing | d) neither increasing nor decreasing

15. The maximum value of f(x) = $(x - 2)(x - 3)^2$ is **[1]**

a) $\frac{7}{3}$ | b) 0

c) $\frac{4}{27}$ | d) 3

16. If the function f(x) = $x^2 - kx + 5$ is increasing on [2, 4], then **[1]**

a) $k \in (-\infty, 2)$ | b) $k \in (2, \infty)$

c) $k \in (4, \infty)$ | d) $k \in (-\infty, 4)$

17. Minimum value of the function f(x) = $x^2 + x + 1$ is **[1]**

a) 2 | b) 3

c) $\frac{3}{4}$ | d) 1

18. The minimum value of sin x · cos x is **[1]**

a) $2\sqrt{2}$ | b) $\frac{1}{2}$

c) $\frac{1}{4}$ | d) $\sqrt{2}$

19. The least value of the function f(x) = ax + $\frac{b}{x}$ (a > 0, b > 0, x > 0) is **[1]**

a) 0 | b) 1

c) $2\sqrt{ab}$ | d) $\frac{a}{b}$

20. Let f(x) = $x^{25} (1 - x)^{75}$ for all $x \in [0, 1]$, then f (x) assumes its maximum value at **[1]**

a) $\frac{1}{3}$ | b) $\frac{1}{2}$

c) $\frac{1}{4}$ d) 0

21. The function f(x) = 4 - 3x + $3x^2$ - x^3 is decreasing **[1]**

a) Strictly decreasing on R
b) Strictly increasing on R
c) Decreasing on R
d) Increasing on R

22. The least value of f(x) = (e^x + e^{-x}) is **[1]**

a) 2
b) -2
c) 0
d) 1

23. Let f (x) =x^3, then f (x) has a **[1]**

a) point of inflexion at x = 0
b) local maxima at x = 0
c) point of inflexion at x = 1
d) local minima at x = 0

24. The minimum value of $\frac{x}{\log x}, x > 1,$ is **[1]**

a) $\frac{2}{e}$
b) e
c) – e
d) $\frac{1}{e}$

25. Given that f (x) = $x^{1/x}$, x > 0 has the maximum value at x = e,then **[1]**

a) $e^{\pi} = \pi^{e}$
b) $e^{\pi} \leqslant \pi^{e}$
c) $e^{\pi} > \pi^{e}$
d) $e^{\pi} < \pi^{e}$

26. The function f(x) = $\log_e \left(x^3 + \sqrt{x^6 + 1}\right)$ is of the following types: **[1]**

a) even and increasing
b) odd and decreasing
c) even and decreasing
d) odd and increasing

27. The function f(x) = 4 $\sin^3$x - 6 $\sin^2$x + 12 sinx + 100 is strictly **[1]**

a) increasing in $\left(\pi, \frac{3\pi}{2}\right)$
b) decreasing in $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$
c) decreasing in $\left(\frac{\pi}{2}, \pi\right)$
d) decreasing in $\left[0, \frac{\pi}{2}\right]$

28. The values of x for which y = $[x(x - 2)]^2$ is an increasing function, are **[1]**

a) 0 < x < 2 and x > 3
b) 0 < x < $\frac{3}{2}$ and x > 4
c) 0 < x < 1 and x > 2
d) 0 < x < $\frac{1}{2}$ and x > $\frac{3}{2}$

29. f(x) = 1 + 2 sin x + 3 $\cos^2$x, $0 \leq x \leq \frac{2\pi}{3}$ is **[1]**

a) Minimum at x = $\frac{\pi}{2}$
b) Maximum at $\sin^{-1}(\frac{1}{6})$
c) Minimum at x = $\frac{\pi}{6}$
d) Maximum at x = $\sin^{-1}(\frac{1}{\sqrt{3}})$

30. The function y = x^2e^{-x} is decreasing in the interval **[1]**

a) $(-\infty, 0) \cup (2, \infty)$
b) (0, 2)
c) $(-\infty, 0)$
d) $(2, \infty)$

31. The maximum value of $\left(\frac{\log x}{x}\right)$ is **[1]**

a) 1
b) e

c) $\frac{2}{e}$ d) $\left(\frac{1}{e}\right)$

32. Let $\phi(x)$ = f(x) + f(2a - x) and f(x)> 0 for all x$\in$ $[0, a]$ then $\phi(x)$ **[1]**

a) decreases on [0, a] b) increases on [- a , 0]

c) increases on [0, a] d) decreases on [a, 2a]

33. The function f(x) = x^3 + 3x is increasing in interval **[1]**

a) $\mathbb{R}$ b) $(0, \infty)$

c) $(-\infty, 0)$ d) (0, 1)

34. If f(x) = $\frac{x}{\sin x}$ and g(x) = $\frac{x}{\tan x}$, where 0 < x $\leq$ 1, then in the interval **[1]**

a) f(x) is an increasing function b) both f(x) and g(x) are increasing functions

c) both f(x) and g(x) are decreasing functions d) g(x) is an increasing function

35. Which of the following functions is decreasing on $\left(0, \frac{\pi}{2}\right)$ **[1]**

a) cos x b) cos 3x

c) tan x d) sin 2x

36. The minimum value of f(x) = $3x^4$ - $8x^3$ - 48x + 25 on [0, 3] is **[1]**

a) 25 b) 16

c) -39 d) 36

37. Function f(x) = $2x^3$ - $9x^2$ + 12 x + 29 is monotonically decreasing when **[1]**

a) x > 2 b) 1 < x < 2

c) x < 2 d) x > 3

38. let f(x) = x^3 - $6x^2$ + 15x + 3. Then **[1]**

a) f(x) is invertible b) f(x) > f(x + 1) for all x $\in$ R

c) f(x) < 0 for all x$\in$ R d) f(x) > 0 for all $\in$ R

39. The values of a for which the function f(x) = sin x - ax + b increases on R are **[1]**

a) $(-\infty, \infty)$ b) [1, 1]

c) (-∞, -1) d) [-1, 1]

40. The function f(x) = $\frac{5}{x} - 9$ is of which nature for x $\in$ R, (x $\neq$ 0). **[1]**

a) strictly decreasing b) increasing

c) strictly increasing d) decreasing

41. f(x) = sin x is increasing in **[1]**

a) $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ b) $\left(\pi, \frac{3\pi}{2}\right)$

c) $(0, \pi)$ d) $\left(\frac{\pi}{2}, \pi\right)$

42. The maximum value of f(x) = $\frac{x}{4+x+x^2}$ on [-1, 1] is **[1]**

a) $-\frac{1}{4}$ b) $\frac{1}{5}$

c) $\frac{1}{6}$ d) $-\frac{1}{3}$

43. If the rate of change of radius of a circle is 6 cm/s, then find the rate of change of area of the circle, when r = 3. **[1]**

a) 12π cm^2/s
b) 21π cm^2/s
c) 36π cm^2/s
d) 24π cm^2/s

44. The function/(x) = 3x + cos 3x is **[1]**

a) Strictly increasing on R
b) Strictly decreasing on R
c) Increasing on R
d) Decreasing on R

45. The function f(x) = tan x - x **[1]**

a) never increases
b) sometimes increases and sometimes decreases
c) always increases
d) always decreases

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

a) (4 ,∞)
b) (-∞, 8)
c) (8, ∞)
d) (-∞, 4)

47. The function f(x) = $\frac{2x^2-1}{x^4}$, x > 0, decreases in the interval **[1]**

a) (-∞, 0)
b) [1, ∞)
c) [1, 1]
d) [-1, -1]

48. Let f(x) = 2 sin^{3}x - 3 sin^{2}x + 12 sin x + 5, $0 \leq x \leq \frac{\pi}{2}$. Then f(x) is **[1]**

a) increasing in $\left[0, \frac{\pi}{2}\right]$
b) increasing in $\left[1, \frac{\pi}{4}\right]$ and decreasing in $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$
c) decreasing in $\left[0, \frac{\pi}{2}\right]$
d) increasing in $\left[0, \frac{\pi}{4}\right]$ and decreasing in $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

49. Function f(x) = |x| - |x - 1| is monotonically increasing when **[1]**

a) x < 1
b) 0 < x < 1
c) x < 0
d) x > 1

50. Find the maximum and minimum values of f(x) = x + sin 2x in the interval [0, 2π]. **[1]**

a) Maximum value = 0
Minimum value = 0
b) Maximum value = 1
Minimum value = 1
c) Maximum value = 0
Minimum value = 2π
d) Maximum value = 2π
Minimum value = 0

51. The function f(x) = $\frac{-x}{2}$ + sin x defined on [$\frac{-n}{3}$, $\frac{71}{3}$] is **[1]**

a) Falls
b) decreasing
c) increasing
d) constant

52. The condition that the curve ax^2 + by^2 = 1 and a_1x^2 + b_1y^2 = 1 may cut each other orthogonally is **[1]**

a) $a_1 + a = b_1 + b$
b) $\frac{1}{a_1} + \frac{1}{a} = \frac{1}{b_1} + \frac{1}{b}$

c) $a_1 - a = b_1 - b$ d) $\frac{1}{a_1} - \frac{1}{a} = \frac{1}{b_1} - \frac{1}{b}$

53. If the function f(x) = $kx^3 - 9x^2 + 9x + 3$ is monotonically increasing in every interval, then **[1]**

a) k > 3 b) k < 3

c) $k \geq 3$ d) $k \leq 3$

54. The least and greatest values of f(x) = $x^3 - 6x^2 + 9x$ in [0, 6], are **[1]**

a) none of these b) 0,6

c) 3,6 d) 0,3

55. If ax + $\frac{b}{x} \geq$ c for all positive x where a, b, > 0, then **[1]**

a) ab < $\frac{c^2}{4}$ b) ab $\geq \frac{c^2}{4}$

c) ab $\geq \frac{c}{4}$ d) ab $\geq \frac{c}{2}$

56. The minimum value of f(x) = 3 $\cos^2$x + 4 $\sin^2$x + cos$\frac{x}{2}$ + sin$\frac{x}{2}$ is **[1]**

a) 4 + $\sqrt{2}$ b) 3 + $\sqrt{2}$

c) 4 - $\sqrt{2}$ d) 4

57. If the function f(x) = $x^3 - 9kx^2 + 27x + 30$ is increasing on R, then **[1]**

a) 0 < k < 1 b) -1 < k < 1

c) k < - 1 or k > 1 d) -1 < k < 0

58. A function f : R $\rightarrow$ R is defined as f(x) = x^3 + 1.Thenthe function has **[1]**

a) both maximum and minimum values b) neither maximum value nor minimum value

c) no minimum value d) no maximum value

59. If a > b > 0, the minimum value of a sec θ - b tan θ is **[1]**

a) $2\sqrt{a^2 - b^2}$ b) $\sqrt{a^2 + b^2}$

c) $\sqrt{a^2 - b^2}$ d) b - a

60. The function given f(x) = e^{2x} is ...A... on R. Here, A refers to ________. **[1]**

a) neither increasing nor decreasing b) Decreasing

c) strictly increasing d) strictly decreasing

61. The radius of the base of a cone is increasing at the rate of 3 cm/minute and the altitude is decreasing at the rate of 4 cm/minute. The rate of change of lateral surface when the radius = 7cm and altitude 24 cm is **[1]**

a) $7\pi \text{cm}^2/\text{min}$ b) $54\pi \text{cm}^2/\text{min}$

c) $29 \text{cm}^2/\text{min}$ d) $27 \text{cm}^2/\text{min}$

62. Interval(s) in which the function f(x) = sin x + cos x, $x \in \left(0, \frac{\pi}{2}\right)$ is strictly increasing **[1]**

a) $\left(0, \frac{\pi}{4}\right)$ b) $\left(\pi, \frac{\pi}{2}\right)$

c) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ d) $\left(0, \frac{\pi}{2}\right)$

63. The function f(x) = 2log (x - 2) - x^2 + 4x + 1 increases on the interval **[1]**

a) $(1, 2) \cup (3, \infty)$ b) (2 ,4)

c) $(-\infty, 1) \cup (2, 3)$ d) (1 , 3)

64. It is given that for the function f given by f(x) = $x^3 + bx^2 + ax$, x $\in$ [1, 3], then **[1]**

a) a = -6, b = -11 b) a = - 6, b = 11

c) a = 11, b = -6 d) a = 6, b = 11

65. In a sphere of radius r, a right circular cone of height h having maximum curved surface area is inscribed. The expression for the square of curved surface of cone is **[1]**

a) $2\pi^2 rh(2rh + h^2)$ b) $2\pi^2 r^2(2rh - h^2)$

c) $\pi^2 hr(2rh + h^2)$ d) $2\pi^2 r(2rh^2 - h^3)$

66. The maximum value of $x^{\frac{1}{x}}$, x > 0 is **[1]**

a) $\left(\frac{1}{e}\right)^e$ b) 1

c) $e^{\frac{1}{e}}$ d) 0

67. The point on the curve $y^2 = 4x$ which is nearest to the point (2,1) is **[1]**

a) $(1, 2\sqrt{2})$ b) (-2, 1)

c) (1, -2) d) (1, 2)

68. If f(x) = a $\log_e |x| + bx^2 + x$ has extremum at x = 1 and x = 3 then **[1]**

a) $a = -\frac{3}{4}, b = \frac{1}{8}$ b) $a = -\frac{3}{4}, b = -\frac{1}{8}$

c) $a = \frac{3}{4}, b = -\frac{1}{8}$ d) $a = -\frac{1}{4}, b = \frac{3}{8}$

69. The function f(x) = $\frac{3}{x} + 7$ is strictly decreasing in the interval **[1]**

a) $(-\infty, \infty) - \{0\}$ b) $(-1, \infty)$

c) $(-\infty, 1)$ d) $(1, \infty)$

70. It is given that at x = 1, the function f(x) = $x^4 - 62x^2 + ax + a$ attains its maximum value, on the interval [0, 2]. The value of a is **[1]**

a) 20 b) -120

c) 120 d) 52

71. The function f(x) = x^x decreases on the interval **[1]**

a) (0, e) b) (0, 1)

c) (1/e,e) d) $(0, \frac{1}{e})$

72. Let h(x) = f(x) - $\{f(x)\}^2 + \{f(x)\}^3$ for all real values of x. Then **[1]**

a) h is increasing whenever f'(x) < 0 b) h is decreasing whenever/is increasing

c) nothing can be said in general d) h is increasing whenever f(x) is increasing

73. The maximum and minimum values of the function $2x^3 - 15x^2 + 36x + 11$ are respectively **[1]**

a) 39, 35 b) 39, 18

c) 38, 37 d) 39, 38

74. The number of values of x where the function $f(x) = \cos x + \cos(\sqrt{2}x)$ attains its maximum is **[1]**

a) 2

b) infinite

c) 1

d) 0

75. $f(x) = \sin x \sqrt{3} \cos x$ is maximum when x = **[1]**

a) $\frac{\pi}{6}$

b) $\frac{\pi}{4}$

c) 0

d) $\frac{\pi}{3}$