

TOPIC: APPLICATION OF DERIVATIVES

Page | 1

- Using differentials, find the approximate value of $(3.968)^{3/2}$.
- Find the approximate value of $f(3.01)$, upto 2 places of decimal, where $f(s) = 3x^2 + 5x + 3$.
- Using differentials, find approximate value $\sqrt{49.5}$
- If the radius of sphere is measured as 9 cm with an error of 0.03 cm, then the approximate error in calculating its surface area.
- If $f(x) = 3x^2 + 15x + 5$, then find the approximate value of $f(3.02)$ using differentials
- The length x of a rectangle is decreasing at the rate of 5 cm / min and the width y is increasing at the rate of 4 cm / min. When $x = 8$ cm and $y = 6$ cm, find the rate of change of
 - The perimeter
 - Area of rectangle
- Sand is pouring from the pipe at the rate of $12 \text{ cm}^3/\text{s}$. the falling sand forms a cone on a ground in such a way that the height of cone is always one-sixth of radius of the base. How fast is the height of sand cone increasing when the height is 4 cm?
- A ladder 5 m long is leaning against a wall. Bottom of ladder is pulled along the ground away from wall at the rate of 2 m/s. How fast is the height on the wall decreasing, when the foot of ladder is 4m away from the wall?
- The amount of pollution content added in air in a city due to x diesel vehicles is given by
$$P(x) = 0.005x^3 + 0.02x^2 + 30x$$
Find the marginal increase in pollution content when 3 diesel vehicle are added and write which value is indicated in the above question?
- The total cost $C(x)$ associated with provision of free mid-day meals to x students of a school in primary classes is given by $C(x) = 0.005x^3 - 0.02x^2 + 30x + 50$.

If the marginal cost is given by rate of change $\frac{dC}{dx}$ of total cost, then write the marginal cost of food for 300 students. What value is shown here?

11. The money to be spent for the welfare of the employees of a firm is proportional to the rate of change of its total revenue (marginal revenue). If the total revenue (in Rs.) received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$, then find the marginal revenue, when $x = 5$ and write which value does the question indicate.

12. Show that $y = \log(1+x) - \frac{2x}{2+x}$, $x > -1$ is an increasing function of x , throughout its domain.

13. Find the intervals in which the function given by $f(x) = \sin x + \cos x$, $0 \leq x \leq 2\pi$ is

- increasing
- decreasing

14. Find the intervals in which the function given by $f(x) = x^4 - 8x^3 + 22x^2 - 24x + 21$ is

- increasing
- decreasing

Q. 1 Find the intervals in which the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is

- Strictly increasing
- Strictly decreasing

Q. 2 Find the intervals in which the function given by $f(x) = \frac{3}{10}x^4 - \frac{4}{5}x^3 - 3x^2 + \frac{36x}{5} + 11$ is

- Strictly increasing
- Strictly decreasing

Q. 3 Find the value(s) of x for which $y = [x(x-2)^2]$ is an increasing function.

15. Find the intervals in which the function $f(x) = \sin x + \cos x$, $0 \leq x \leq 2\pi$ is strictly increasing or decreasing.

16. Show that the function $f(x) = x^3 - 3x^2 + 3x$, $x \in \mathbb{R}$ is increasing on \mathbb{R} .

17. Find the intervals in which the function $f(x) = (x-1)^3(x-2)^2$ is

- increasing
- decreasing

18. Find the intervals in which the function

$$f(x) = 2x^3 + 9x^2 + 12x + 20 \text{ is}$$

- (i) Increasing
- (ii) decreasing

20. Find the intervals in which the function

$$f(x) = 2x^3 - 9x^2 + 12x - 15 \text{ is}$$

- (i) Increasing
- (ii) decreasing

21. Find the intervals in which the function

$$f(x) = 2x^3 - 15x^2 + 36x + 17 \text{ is}$$

- (i) Increasing
- (ii) decreasing

22. Prove that the function f defined by $f(x) = x^2 - x + 1$ is neither increasing nor decreasing in $(-1, 1)$. Hence, find the intervals in which $f(x)$ is

- (i) Strictly increasing
- (ii) Strictly decreasing

23. Find the intervals in which the function $f(x) = 20 - 9x + 6x^2 - x^3$ is

- (i) Strictly increasing
- (ii) Strictly decreasing

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- (iii) Find the intervals in which the function f given by $f(x) = \sin x - \cos x$, $0 \leq x \leq 2\pi$ is Strictly increasing or Strictly decreasing.

24. Find the intervals in which the function

$$f(x) = 2x^3 - 9x^2 + 12x + 15 \text{ is}$$

- (iii) Increasing
- (iv) decreasing

25. Find the intervals in which the function

$$f(x) = (x-1)(x-2)^2 \text{ is}$$

- (v) Increasing
- (vi) decreasing

26. Find the intervals in which

$$f(x) = x^3 - 12x^2 + 36x + 17 \text{ is}$$

- (vii) Increasing
- (viii) decreasing function

27. Prove that $y = \frac{4 \sin \theta}{2 + \cos \theta} - \theta$ is an increasing function in $\left[0, \frac{\pi}{2}\right]$

Page | 4

28. Find the intervals in which the function

$$f(x) = \frac{3}{2}x^4 - 4x^3 - 45x^2 + 51$$

- (i) Strictly increasing
- (ii) Strictly decreasing

29. Find the intervals in which the function f given by

$$f(x) = x^3 + \frac{1}{x^3}, x \neq 0 \text{ is}$$

- (ix) Increasing
- (x) decreasing

30. Find the equations of the tangents to the curves $y = x^2 - 2x + 7$ which is

- (i) Parallel to the line $2x - y + 9 = 0$
- (ii) Perpendicular to the line

31. Find the equation of the normal at a point on the curve $x^2 = 4y$, which passes through the point $(1, 2)$. Also, find the equation of the corresponding tangent.

32. Find the equations of tangents to the curve $3x^2 - y^2 = 8$, which passes through the point $\left(\frac{4}{3}, 0\right)$.

33. For the curve $y = 4x^3 - 2x^5$, find all the points on the curve at which the tangent passes through the origin.

34. Find the equations of tangent and normal to the curve $x = 1 - \cos \theta, y = \theta - \sin \theta$ at $\theta = \frac{\pi}{4}$

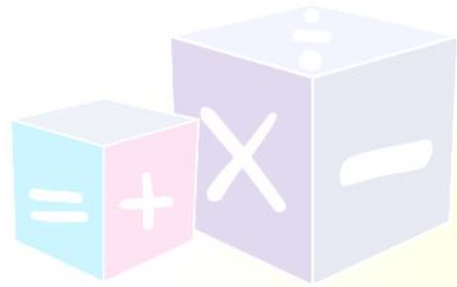
35. Find the equations of the tangents and normal to the curve $\frac{x^2}{d^2} - \frac{y^2}{b^2} = 1$ at the point $(\sqrt{2}a, b)$

36. Find the points on curve $y = x^3 - 11x + 5$ at which equation of tangent is $y = x - 11$.

37. Find the points on the curve $x^2 + y^2 - 2x - 3 = 0$ at which tangent is parallel to $x -$ axis.
38. Find the points on the curve $y = x^3$ at which the slope of the tangent is equal to $y -$ coordinate of the point.
39. Find the equation of tangent to curve $x = \sin 3t, y = \cos 2t$ at $\frac{\pi}{4}$.
40. Find the equations of tangents to the curve $y = (x^2 - 1)(x - 2)$ at the points, where the curve cuts the $X -$ axis.
41. Find the equation of tangent to the curve $4x^2 + 9y^2 = 36$ at the point $(3 \cos \theta, 2 \sin \theta)$.
42. Find the equations of the normal to the curve $y = x^3 + 2x + 6$, which are parallel to line $x + 14y + 4 = 0$.
43. Find the equation of tangent to the curve $x^2 + 3y = 3$, which is parallel to line $y - 4x + 5 = 0$
44. Find the equation of tangent to the curve $y = \sqrt{3x - 2}$, which is parallel to the line $4x - 2y + 5 = 0$.
45. At what points will the tangent to the curve $y = 2x^3 - 15x^2 + 36x - 21$ be parallel to $X -$ axis? also, find the equations of tangents to the curve.
46. Find the slope of the tangent to the curve $y = 3x^2 - 6$ at the point on it whose $x -$ coordinate is 2.
47. Find the slope of the tangent to the curve $y = 3x^2 - 4$ at point whose $x -$ coordinates is 2
48. Find the slope if the tangent to the curve $y = 3x^4 - 4x$ at $x = 1$
49. For the curve $y = 3x^2 + 4x$, find the slope of tangent to the curve at point, where $x -$ coordinate is -2 .
50. Find the equation of the tangent and normal to the curve $x = a \sin^3 \theta$ and $y = a \cos^3 \theta$ at $\theta = \frac{\pi}{4}$
51. Find the equation of tangent to the curve $y = x^4 - 6x^3 - 10x + 5$ at point $x = 1, y = 0$.
52. Find the values of x for which $f(x) = [x(x - 2)]^2$ is an increasing function. Also, find the points on the curve, where the tangent is parallel to $X -$ axis.

53. Find the equation of tangent to the curve $y = \frac{x-7}{x^2-5x+6}$ at the point, where it cuts the X – axis.

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