16.APPLICATIONS OF DERIVATIVES

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Section-A JEE Advanced/IIT-JEE

C.MCQ with One Correct Answer

- 1) If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$ (2004S)
 - a) f(x) is a strictly increasing function
 - b) f(x) has a local maxima
 - c) f(x) is a strictly decreasing function
 - d) f(x) is bounded
- 2) If $f(x) = x^{\alpha} log x$ and f(0) = 0, then the value of α for which Rolles's theorem can be applied in [0, 1] is (2004)
 - a) -2
 - b) -1
 - c) 0
 - d) 1/2
- 3) If P(x) is a polynomial of degree less than or equal to 2 and S is the set of all such polynomials so that P(0) = 0, P(1) = 1 and $P'(x) > 0 \ \forall x \in [0, 1]$, then (2005S)
 - a) $S = \phi$
 - b) $S = ax + (1 a)x^2 \ \forall a \in (0, 2)$
 - c) $S = ax + (1 a)x^2 \ \forall a \in (0, \infty)$
 - d) $S = ax + (1 a)x^2 \ \forall a \in (0, 1)$
- 4) The tangent to the curve $y = e^x$ drawn at the point $(\mathbf{c}, \mathbf{e}^{\mathbf{c}})$ intersects the line joining the points $(c-1, e^{c-1})$ and $(c+1, e^{c+1})$ (2007-3 Marks)
 - a) on the left of x = c
 - b) on the right of x = c
 - c) at no point
 - d) at all points
- 5) Consider the two curves C_1 : $y^2 = 4x, C_2$: $x^2 + y^2 - 6x + 1 = 0$. Then,
 - a) C_1 and C_2 touch each other only at one point.
 - b) C_1 and C_2 touch each other exactly at two

points

c) C_1 and C_2 intersect (but do not touch) at exactly two points

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- d) C_1 and C_2 neither intersect nor touch each other
- 6) The total number of local maxima and local minima of the function

$$f(x) = \begin{cases} (2+x)^3, -3 < x \le -1\\ x^{2/3}, -1 < x < 2 \end{cases}$$
 is (2008)

- a) 0
- b) 1
- c) 2
- d) 3
- 7) Let the function $g:(-\infty,\infty)\to\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ be given by $g(u)=2tan^{-1}(e^u)-\frac{\pi}{2}$. Then, g is (2008)
 - a) even and is strictly increasing in $(0, \infty)$
 - b) odd and is strictly decreasing in $(-\infty, \infty)$
 - c) odd and is strictly increasing in $(-\infty, \infty)$
 - d) neither even nor odd, but is strictly increasing in $(-\infty, \infty)$
- 8) The least value of $a \in \mathbb{R}$ for which $4\alpha x^2 + \frac{1}{x} \ge 1$, (JEE Adv. 2016) for all x > 0, is

 - a) $\frac{1}{64}$ b) $\frac{1}{32}$ c) $\frac{1}{27}$ d) $\frac{1}{25}$
- 9) If $f: R \to R$ is a twice differentiable function such that f''(x) > 0 for all $x \in R$ and $f(\frac{1}{2}) = (\frac{1}{2}), f(1) = 1$, then (JEE Adv. 2017)
 - a) $f'(1) \le 0$
 - b) $0 < f'(1) \le \frac{1}{2}$
 - c) $\frac{1}{2} < f'(1) \le \tilde{1}$
 - d) f'(1) > 1

- D. MCQs With One or More than One Correct
- 1) Let $P(x) = a_0 + a_1x^2 + a_2x^4 + \dots + a_nx^{2n}$ be a polynomial in a real variable x with $0 < a_0 < a_1 < a_2 < \dots + a_n$. The function P(x) has (1986- 2 Marks)
 - a) neither a maximum nor a minimum
 - b) only one maximum
 - c) only one minimum
 - d) only one maximum and only one minimum
 - e) none of these
- 2) If the line ax + by + c = 0 is a normal to the curve xy = 1, then (1986-2 Marks)
 - a) a > 0, b > 0
 - b) a > 0, b < 0
 - c) a < 0, b > 0
 - d) a < 0, b < 0
 - e) none of these.
- 3) The smallest positive root of the equation, tanx x = 0 lies in (1987-2 Marks)
 - a) $(0, \frac{\pi}{2})$
 - b) $\left(\frac{\pi}{2},\pi\right)$
 - c) $\left(\pi, \frac{3\pi}{2}\right)$
 - d) $(\frac{3\pi}{2}, 2\pi)$
 - e) None of these
- 4) Let f and g be increasing and decreasing functions, respectively from $[0, \infty)$ to $[0, \infty)$. Let h(x) = f(g(x)). If h(0) = 0, then h(x) h(1) is (1987-2 Marks)
 - a) always zero
 - b) always negative
 - c) always positive
 - d) strictly increasing
 - e) None of these.
- 5) If $f(x) = \begin{cases} 3x^2 + 12x 1, -1 \le x \le 2\\ 37 x, 2 < x \le 3 \end{cases}$ then: (2008)
 - a) f(x) is increasing on [-1,2]
 - b) f(x) is continuous on [-1,3]
 - c) f'(2) does not exist
 - d) f(x) has the maximum value at x = 2
- 6) Let $h(x) = f(x) (f(x))^2 + (f(x))^3$ for every real number x. Then (1998-2 Marks)

- a) h is increasing whenever f is increasing
- b) h is increasing whenever f is decreasing
- c) h is decreasing whenever f is decreasing
- d) nothing can be said in general.