IIT/EKLAVYA BATCH

THE GURUKUL INSTITUTE

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DAILY PRACTICE PROBLEMS

DIFFERENTIATION

1. If f(x) = $log_{sec 2x} |\cos 4x| + |\sin x|$ then find $\frac{dy}{dx}$ $at\ x = -\frac{\pi}{6}$ from the first principle.
2. Let a+b =1, $2a^2+2b^2$ =1 and f(x) be a continuous function such that f (2+x) +f(x) = 2 for all xÎ(0, 2) and p =$\int_0^4 f(x)dx - 4, q = \frac{\alpha}{\beta}$ then find the least positive integral values of 'a' for which the equation ax^2-bx+c = 0 has both roots lies between p and q.
3. Let f be differentiable function such that, $f^1(x) = f(x) + \int_0^2 f(x)dx, f(0) = \frac{4-e^2}{3}$ find f(x)?
4. Let f(x+y) = f(x) –f (y) + 2xy -1 for all x, y ÎR, if f(x) is differentiable and $f^1(0) = \sqrt{-3+a-a^2}$ prove that f(x)>0 for all xÎR.
5. If $2x = y^{1/5} + y^{-1/5}$ then express y as an explicit function x and prove that
   $(x^2-1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 25y$
6. Find $\frac{dy}{dx}$ $if\ y = (sinx)^{\sin x^{\sin x^{\sin x}}}$ $^{-\infty}$
7. Differentiation of a function w.r.t other functions: $\frac{df(x)}{d\varphi(x)} = \frac{\frac{d}{dx}f(x)}{\frac{d}{dx}\varphi(x)} = \frac{f^1(x)}{\varphi^1(x)}$
8. Differentiate ln tanx with respect to $\sin^{-1}(e^x)$
9. Differentiate $\frac{\sin x+\cos x}{\sin x-\cos x}$ with respect to x.
10. If $\mu = f(x^2)$, v = g (x^3), $f^1(x)$ = sin x and $g^1(x)$ = cos x ,then find $\frac{du}{dv}$.
11. If y^2 = p(x) a polynomial of degree 3 then find $2\frac{d}{dx}\left(y^3\frac{d^2y}{dx^2}\right)$ in terms of P(x) and its derivative.
12. If x = a (t+sint) and y = a (1-cost), Then find $\frac{d^2y}{dx^2}$.
13. If y = $\sqrt{\frac{1-sin 2x}{1+sin 2x}}$, show that $\frac{dy}{dx}$ + $\sec^2(\frac{\pi}{4} - x)$= 0.
14. Prove that : $\frac{d}{dx}\left[\frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a}\right] = \sqrt{a^2-x^2}$.
15. If x = a $\left(\frac{1+t^2}{1-t^2}\right)$ and y = $\frac{2t}{1-t^2}$, find$\frac{dy}{dx}$.
16. If f(x) = $\left(\frac{3+x}{1+x}\right)^{2+3x}$, find f'(0) .
17. If x = 3 sin t – sin 3 t , y = 3cost - cos 3t, find $\frac{d^2y}{dx^2}$ at t = $\frac{\pi}{3}$.
18. Differentiate, x^x $\sin^{-1}\sqrt{x}$ w.r.t x.
19. If y = $\sqrt{x^2+1}$ - log $\left(\frac{1}{x} + \sqrt{1+\frac{1}{x^2}}\right)$, find $\frac{dy}{dx}$.
20. Solve the differential equation $\frac{dy}{dx}$ - 3y cotx = sin2x ; y = 2 when x = $\frac{\pi}{2}$.
21. Differentiate $(x\cos x)^x + (x\sin x)^{\frac{1}{x}}$
22. Solve the differential equation: $ye^{x/y}dx = \left(xe^{x/y} + y\right)dy$