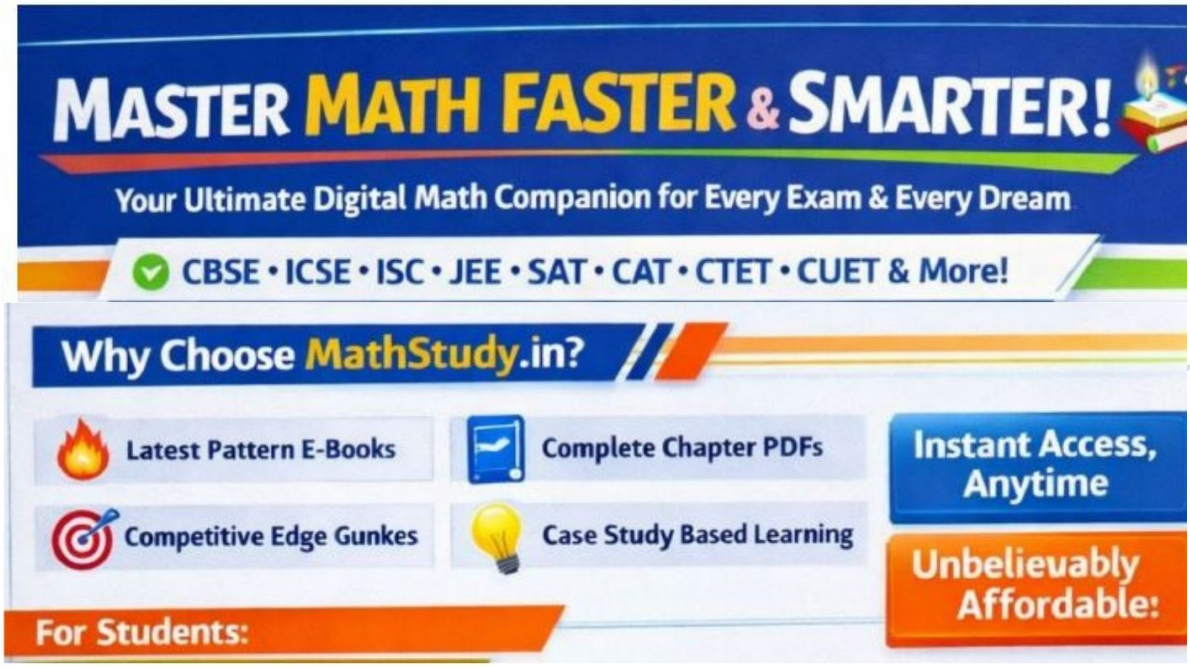
Unit III: Calculus - Differential Equations

General Instructions

1. Total Questions: **20**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Read each question carefully before answering.
5. Choose the most appropriate answer from the given options.
6. Use of calculator or electronic devices is strictly prohibited.

1. Find the general solution of the differential equation: $\frac{dy}{dx} = \frac{x+y+1}{2x+2y+3}$.
2. Solve: $\frac{dy}{dx} + \frac{y}{x} = y^2 \log x$.
3. Find the equation of the curve passing through the point $(1, 1)$ whose differential equation is $xdy = (y + x^2)dx$.
4. Solve the homogeneous differential equation: $(x^2 + xy)dy = (x^2 + y^2)dx$.
5. Find the particular solution of the differential equation $\frac{dy}{dx} + y \cot x = 4x \text{ cosec } x$, given that $y = 0$ when $x = \pi/2$.
6. Solve: $(1 + y^2)dx = (\tan^{-1} y - x)dy$.
7. Find the general solution of $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$.
8. Solve the differential equation $x\frac{dy}{dx} - y + x \sin(\frac{y}{x}) = 0$.
9. Find the orthogonal trajectory of the family of parabolas $y^2 = 4ax$.
10. Solve: $\frac{dy}{dx} = \frac{y}{x} + \frac{\sqrt{x^2+y^2}}{x}$.
11. A curve passes through $(2, 0)$ and the slope of the tangent at any point (x, y) is $\frac{(x+1)^2+(y-3)}{x+1}$. Find the equation of the curve.
12. Solve the differential equation $e^y \frac{dy}{dx} + \frac{e^y}{x} = \frac{1}{x^2}$.
13. Find the general solution of $ydx + (x - y^3)dy = 0$.
14. Solve: $x^2 \frac{dy}{dx} = y^2 + 2xy$ with the condition $y(1) = 1$.
15. Find the solution of the differential equation $\frac{dy}{dx} + \frac{3x^2y}{1+x^3} = \frac{\sin^2 x}{1+x^3}$.
16. Solve: $\frac{dx}{dy} + \frac{x}{y} = y^2$.
17. Find the equation of a curve such that the projection of the sub-tangent at any point on the x-axis is of constant length k.
18. Solve: $(x + y + 1)dy = dx$.
19. Find the general solution of $(x \cos \frac{y}{x} + y \sin \frac{y}{x})ydx = (y \sin \frac{y}{x} - x \cos \frac{y}{x})xdy$.
20. Solve the differential equation $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$.



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