CUET Mathematics Test - Set 6

Chapter: Differential Equations (Order, Degree, and Variable Separable)

SOLUTIONS

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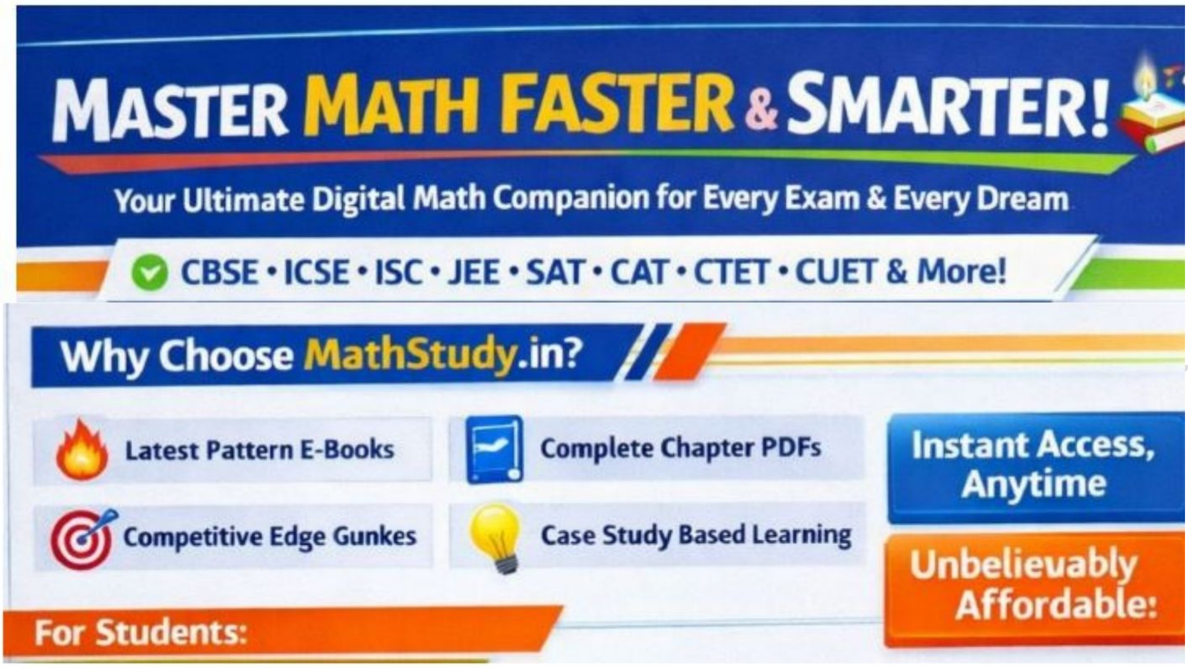

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Solutions

1. **Correct Option: (A)**. Cubing both sides: $[1+(y')^2]^5 = (y''')^3$. The highest order derivative is y''' and its power is 3.

2. **Correct Option: (B)**. Equation is $y^2 = 4a(x-h)$ or $y^2 = 4ax + c$. There are 2 arbitrary constants. Differentiating twice gives order 2, and the resulting DE is linear in y''.

3. **Correct Option: (B)**. $\frac{dy}{dx} = \frac{2^y}{2^x} \Rightarrow 2^{-y}dy = 2^{-x}dx$. Integrating: $\frac{2^{-y}}{-\log 2} = \frac{2^{-x}}{-\log 2} + C' \Rightarrow 2^{-x} - 2^{-y} = C$.

4. **Correct Option: (B)**. $\log y = cx$. Differentiating: $\frac{1}{y}y' = c$. Substitute $c = \frac{\log y}{x}$: $\frac{y'}{y} = \frac{\log y}{x} \Rightarrow xy' = y \log y$.

5. **Correct Option: (C)**. $\frac{dy}{1+y^2} = \frac{xdx}{1+x^2}$. Integrating: $\tan^{-1} y = \frac{1}{2}\log(1+x^2)$. However, look at the log form: $\frac{1}{2}\log(1+y^2) = \frac{1}{2}\log(1+x^2) + \log C \Rightarrow 1 + y^2 = C^2(1+x^2)$.

6. **Correct Option: (D)**. The equation is not a polynomial in derivatives because $\frac{d^2y}{dx^2}$ is inside a logarithm.

7. **Correct Option: (A)**. $\frac{dy}{1+y} = \frac{dx}{1-x}$. Integrating: $\log(1+y) = -\log(1-x) + \log C \Rightarrow \log(1+y) + \log(1-x) = \log C \Rightarrow (1+y)(1-x) = C$.

8. **Correct Option: (B)**. $(x-h)^2 + (y-k)^2 = a^2$. h and k are arbitrary constants (2 constants).

9. **Correct Option: (A)**. Let $x + y = u \Rightarrow 1 + y' = u'$. $u' - 1 = \sin u \Rightarrow \frac{du}{1+\sin u} = dx$. Multiply by $(1 - \sin u)$: $\int(\sec^2 u - \sec u \tan u)du = x + C \Rightarrow \tan u - \sec u = x + C$.

10. **Correct Option: (B)**. $\frac{dy}{dx} = x^2 \Rightarrow y = \frac{x^3}{3} + C$. At $(0, 1)$, $1 = 0 + C \Rightarrow C = 1$.

11. **Correct Option: (A)**. $y = mx \Rightarrow m = y/x$. Differentiating $y = mx$: $y' = m$. Substitute m: $y' = y/x \Rightarrow y = xy'$.

12. **Correct Option: (D)**. $\frac{dy}{dx} = e^x(e^y + e^{-y}) \Rightarrow \frac{dy}{e^y+e^{-y}} = e^x dx \Rightarrow \frac{e^y dy}{e^{2y}+1} = e^x dx$. Let $e^y = t$. $\int \frac{dt}{t^2+1} = \tan^{-1}(e^y) = e^x + C$. (Note: Choice D reflects the transformed tangent form).

13. **Correct Option: (B)**. Order $= 3$, Degree $= 2$. Sum $= 3 + 2 = 5$.

14. **Correct Option: (B)**. This is a Bernoulli-type or specific substitution equation. Let $xy = v \Rightarrow xy' + y = v'$.

15. **Correct Option: (C)**. $\frac{dy}{y} = \frac{dx}{x} \Rightarrow y = Cx$. Through $(1, 1)$, $y = x$. Area under $y = x$ from $x = 0$ to $x = 2$ is $\int_0^2 x dx = 2$. However, the question usually implies between the ordinates given ($x = 1$ to $x = 2$): $\int_1^2 x dx = [x^2/2]_1^2 = 2 - 1/2 = 3/2$.