CUET Mathematics Test

Chapter: Differential Equations

General Instructions

1. Total Questions: **20**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Each question carries **5 marks**.
5. For each correct answer: **+5 marks**.
6. For each incorrect answer: **-1 mark**.
7. No negative marking for unanswered questions.
8. Use of calculator or electronic devices is strictly prohibited.
9. Choose the most appropriate answer from the given options.

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1. The degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2} = \frac{d^2y}{dx^2}$ is:
   (A) 1
   (B) 2
   (C) 3
   (D) Not defined

2. The order and degree (if defined) of the differential equation $\frac{d^2y}{dx^2} + \sin\left(\frac{dy}{dx}\right) = 0$ are respectively:
   (A) 2, 1
   (B) 1, 2
   (C) 2, Not defined
   (D) 1, Not defined

3. The number of arbitrary constants in the general solution of a differential equation of fourth order is:
   (A) 0
   (B) 2
   (C) 3
   (D) 4

4. The number of arbitrary constants in the particular solution of a differential equation of third order is:
   (A) 3
   (B) 2
   (C) 1
   (D) 0

5. The solution of the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ is:
   (A) $\tan^{-1} y + \tan^{-1} x = C$
   (B) $\tan^{-1} y - \tan^{-1} x = C$
   (C) $x + y = C(1 - xy)$
   (D) Both (B) and (C)

6. The integrating factor of the differential equation $\frac{dy}{dx} + y\tan x = \sec x$ is:
   (A) $\cos x$
   (B) $\sec x$
   (C) $e^{\tan x}$
   (D) $\sin x$

7. The general solution of the differential equation $e^x dy + (ye^x + 2x)dx = 0$ is:
   (A) $ye^x + x^2 = C$
   (B) $ye^x - x^2 = C$
   (C) $ye^{-x} + x^2 = C$
   (D) $y + x^2e^{-x} = C$

8. Which of the following is a homogeneous differential equation?
   (A) $(4x + 6y + 5)dy - (3y + 2x + 4)dx = 0$
   (B) $(xy)dx - (x^3 + y^3)dy = 0$
   (C) $(x^3 + 2y^2)dx + 2xydy = 0$
   (D) $y^2dx + (x^2 - xy - y^2)dy = 0$

9. To solve the homogeneous differential equation $\frac{dy}{dx} = g\left(\frac{y}{x}\right)$, the substitution used is:
   (A) $x = vy$

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(B) $y = vx$
(C) $xy = v$
(D) $y = v/x$

10. The solution of $\frac{dy}{dx} + \frac{y}{x} = x^2$ is:
(A) $xy = \frac{x^4}{4} + C$
(B) $y = \frac{x^3}{4} + C$
(C) $xy = \frac{x^3}{3} + C$
(D) $y = x^2 + C$

11. The differential equation representing the family of curves $y = mx$ is:
(A) $\frac{dy}{dx} = \frac{y}{x}$
(B) $\frac{dy}{dx} = \frac{x}{y}$
(C) $\frac{dy}{dx} = y$
(D) $\frac{dy}{dx} = x$

12. The solution of $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is:
(A) $e^y = e^x + \frac{x^3}{3} + C$
(B) $e^y = e^x + x^2 + C$
(C) $e^{x+y} = x^2 + C$
(D) $e^{y-x} = \frac{x^3}{3} + C$

13. The integrating factor of $\frac{dy}{dx} - \frac{y}{x} = 2x^2$ is:
(A) x
(B) $1/x$
(C) $\log x$
(D) $-x$

14. The general solution of $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$ is:
(A) $\tan\left(\frac{y}{2x}\right) = Cx$
(B) $\cot\left(\frac{y}{2x}\right) = Cx$
(C) $\tan\left(\frac{y}{x}\right) = Cx$
(D) $\sin\left(\frac{y}{x}\right) = Cx$

15. A bacteria culture grows at a rate proportional to its size. If the size doubles in 3 hours, the differential equation governing this is (P is population):
(A) $\frac{dP}{dt} = kP^2$
(B) $\frac{dP}{dt} = k\sqrt{P}$
(C) $\frac{dP}{dt} = kP$
(D) $\frac{dP}{dt} = kt$

16. The particular solution of $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ given $y = 0$ when $x = 0$ is:
(A) $4e^{3x} + 3e^{-4y} = 7$
(B) $4e^{3x} - 3e^{-4y} = 1$
(C) $3e^{3x} + 4e^{-4y} = 7$
(D) $e^{3x} + e^{4y} = 2$

17. The order of the differential equation of all circles of radius r is:
(A) 1
(B) 2
(C) 3
(D) 4

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18. The solution of $(1+x^2)\frac{dy}{dx} + 2xy = \cos x$ is:
    (A) $y(1+x^2) = \sin x + C$
    (B) $y = \sin x(1+x^2) + C$
    (C) $y(1-x^2) = \cos x + C$
    (D) $y = \frac{\cos x}{1+x^2} + C$

19. The curve passing through $(0,1)$ and satisfying $\frac{dy}{dx} = \frac{y}{x^2}$ is:
    (A) $y = e^{1-1/x}$
    (B) $y = e^{1/x}$
    (C) $y = e^{-1/x}$
    (D) $y = e^{1+1/x}$

20. The differential equation of the family of parabolas having vertex at origin and axis along positive y-axis is:
    (A) $x\frac{dy}{dx} = 2y$
    (B) $y\frac{dy}{dx} = 2x$
    (C) $x\frac{dy}{dx} = y$
    (D) $\frac{dy}{dx} = 2xy$

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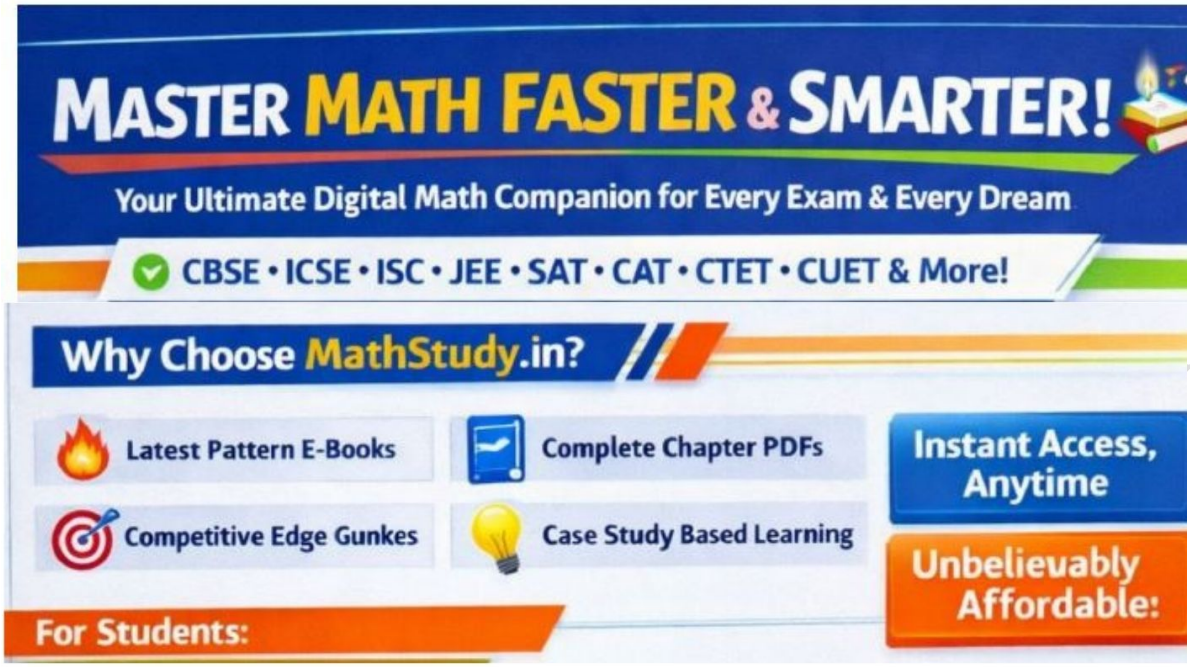

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