N K MATHS ACADEMY

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UNIT TEST 2021-22

MATHEMATICS

MARKS: 50 **TIME: 1.30 HRS**

I. ANSWER ANY 10 QUESTIONS: **10X2=20**

1. Solve $\frac{dy}{dx}=\sqrt{\frac{1-y^2}{1-x^2}}$
2. Determine the order and degree $\left(\frac{d^4y}{dx^4}\right)^3+4\left(\frac{dy}{dx}\right)^7+6y=5\cos 3x$
3. Determine the order and degree $y\frac{dy}{dx}=\frac{x}{\left(\frac{dy}{dx}\right)+\left(\frac{dy}{dx}\right)^3}$
4. Find the differential equation for the family of all straight lines passing through the origin
5. Find the differential equations of the family of all the ellipses having foci on the y -axis and centre at the origin
6. Find the differential equation corresponding to the family of curves represented by the equation $y=Ae^{8x}+Be^{-8x}$, where A and B are arbitrary constants
7. Show that $y=2x^2$ is a solution of the differential equation $xy'=2y$
8. Show that $y=ae^x+be^{-x}$ is a solution of the differential equation $y''-y=0$
9. Find value of m so that the function $y=e^{mx}$ is a solution of the differential equation $y'+2y=0$
10. Express the following physical statement in the form of differential equation: Radium decays at a rate proportional to the amount Q present
11. Find the differential equation of the curve represented by $xy=ae^x+be^{-x}+x^2$
12. Show that $y=a\cos bx$ is a solution of the differential equation $\left(\frac{d^2y}{dx^2}\right)+b^2y=0$

II. ANSWER ANY 5 QUESTIONS: **5X3=15**

13. Solve $(1+x^2)\frac{dy}{dx}=1+y^2$

14. Solve $\sin\left(\frac{dy}{dx}\right) = a$, $y(0) = 1$

15. Solve $\frac{dy}{dx} - x\sqrt{25 - x^2} = 0$

16. Solve $\cos x \frac{dy}{dx} + y \sin x = 1$

17. Solve $x\frac{dy}{dx} + y = x \log x$

18. Solve $(ydx - xdy)\cot\left(\frac{x}{y}\right) = ny^2 dx$

19. Solve $\tan y \frac{dy}{dx} = \cos(x + y) + \cos(x - y)$

III ANSWER THE FOLLOWING: **3X5=15**

20. Solve $\left(x^2 - 3y^2\right)dx + 2xydy = 0$

(Or)

Solve $\left(1 + 2e^{\frac{x}{y}}\right)dx + 2e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)dy = 0$

21. Solve $(1 + x^3)\frac{dy}{dx} + 6x^2 y = 1 + x^2$

(Or)

Solve $\frac{dy}{dx} = \frac{\sin^2 x}{1 + x^3} - \frac{3x^2}{1 + x^3} y$

22. The growth of a population is proportional to the number present. If the population of a colony doubles in 50 years, in how many years will the population become triple?

(Or)

Assume that the rate at which radioactive nuclei decay is proportional to the number of such nuclei that are present in a given sample. In a certain sample 10% of the original number of radioactive nuclei has undergone disintegration in a period of 100 years. What percentage of the original radioactive nuclei will remain after 1000 years?