

THE O.P. GUPTA

ADVANCED MATH CLASSES

Class XII - Mathematics (041)
Topics - Differential Equations

Alpha Test Series-9
(For Academic session 2025-26)

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Max. Marks - 30
Time - 60 Minutes

Followings are of 2 Marks each (Q01-05).

Q01. Write the sum of the degree and order of the D.E. given by $\frac{d}{dx} \left\{ 1 + \left(\frac{dy}{dx} \right)^2 \right\} = \frac{d}{dx} \left\{ \frac{d^2y}{dx^2} \right\}$.

Q02. Find the integration factor of the differential equation : $\sqrt{1-y^2} dx = (\sin^{-1} y - x) dy$.

Q03. Solve the differential equation : $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right) \frac{dx}{dy} = 1, x \neq 0$.

Q04. Show that $(x^2 + y^2) dx - 2xy dy = 0$ is homogeneous differential equation. Write its degree.

Q05. Solve the D.E. given by $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$. [2×5 = 10]

Followings are of 3 Marks each (Q06-07).

Q06. Solve : $y - x \frac{dy}{dx} = a \left(y^2 + \frac{dy}{dx} \right)$.

OR

Solve the differential equation : $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$.

Q07. Solve : $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$. [3×2 = 6]

Following is of 4 Marks (Q08).

Q08. **PASSAGE BASED QUESTION :** An equation involving derivatives of the dependent variable with respect to the independent variable is called a differential equation. A differential equation of the form $\frac{dy}{dx} = F(x, y)$ is said to be homogeneous if $F(x, y)$ is a homogeneous function of degree zero, whereas a function $F(x, y)$ is a homogeneous function of degree 'n' if $F(\lambda x, \lambda y) = \lambda^n F(x, y)$.

To solve a homogeneous differential equation of the type $\frac{dy}{dx} = F(x, y) = g\left(\frac{y}{x}\right)$, we need to make the substitution $y = vx$ and then separate the variables.

Based on the passage given above, answer the following :

(i) Show that $(x e^{\frac{y}{x}} + y) dx = x dy$ is a differential equation of the type $\frac{dy}{dx} = g\left(\frac{y}{x}\right)$.

(ii) Solve the above D.E. to find its particular solution, given that $y = 1$ when $x = 1$. [2×2 = 4]

Followings are of 5 Marks each (Q09-10).

Q09. Find the particular solution of the differential equation : $y e^y dx = (y^3 + 2x e^y) dy, y(0) = 1$.

OR

Find the particular solution of the differential equation

$$\left[1 + y^2 \right] + \left[x - e^{\tan^{-1} y} \right] \frac{dy}{dx} = 0, \text{ given that } y = 0 \text{ when } x = 1.$$

Q10. Check whether the differential equation $x^2 \frac{dy}{dx} - xy = 1 + \cos\left(\frac{y}{x}\right)$, $x \neq 0$ is homogeneous or not.

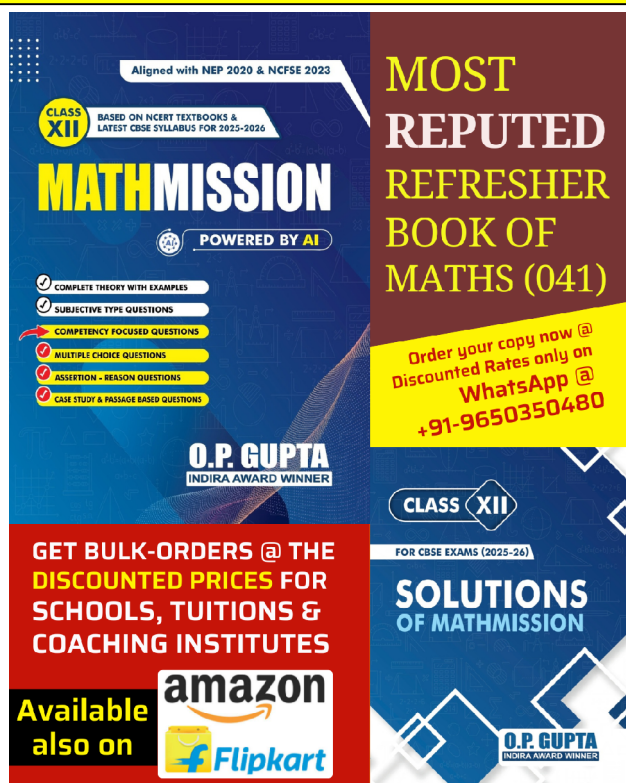
Also find the general solution of the D.E.

[5 × 2 = 10]

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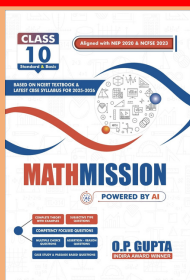
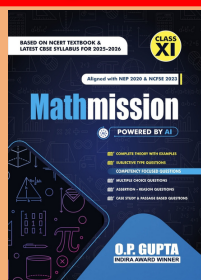
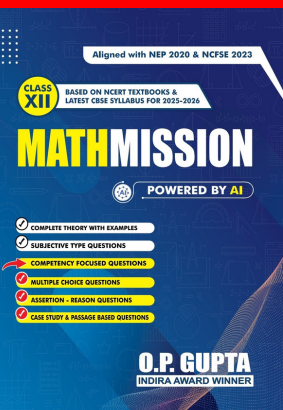
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