CBSE NCERT Based Chapter wise Questions (2025-2026)

Class-XII

Subject: Mathematics

Total : 11 Marks (expected) [MCQ-1 Mark, VSA-2 Marks, SA-3 Marks, LA-5 Marks]

Chapter Name : *Differential Equations* (Chap : 9)

Level 1 & 2 Combined

SECTION – A

MCQ Type (1 mark each):

1. The order of the differential equation $\left(\frac{d^4y}{dx^4}\right)^3 - \frac{d^3y}{dx^3} = \sqrt{1-\frac{dy}{dx}}$ is

   Ⓐ 6 Ⓑ 4 Ⓒ 3 Ⓓ 7

[Hints : Topic order and degree.]

2. Let x be the number of independent arbitrary constants in the general solution of a differential equation of y; then

   Ⓐ $x = y$ Ⓑ $x > y$ Ⓒ $x < y$ Ⓓ $x \geq y$

[Hints : Theorem on order and number of constants.]

3. The order of the differential equation contained by elimination of arbitrary constants from the equation $ax + by + c = 0, c \neq 0$ is

   Ⓐ 2 Ⓑ 3 Ⓒ 1 Ⓓ None

[Hints : Theorem on order and arbitrary constants.]

4. The integrating factor of the differential equation $x\frac{dy}{dx} - y = x^2$

   Ⓐ $\frac{1}{x}$ Ⓑ e^x Ⓒ $e^{2\log_e^X}$ Ⓓ $e^{-2\log_e^X}$

[Hints : Linear differential equation.]

5. In the linear differential equation of the form $\frac{dy}{dx} + Py = Q$

   Ⓐ Q is a constant Ⓑ Q is constant or function of x
   Ⓒ Q is a factor of x Ⓓ Q is a function of both x and y

[Hints : Linear differential equation–general form]

6. The integrating factor of the differential equation $\frac{dy}{dx} + Py = Q$ is

   Ⓐ e^x Ⓑ e^{Px} Ⓒ $e^{\int Pdx}$ Ⓓ None

[Hints : Integrating factor of linear differential equation]

7. To solve the differential equation $\frac{dx}{dy} + Px = Q$, we multiply both sides of the equation by

   Ⓐ e^{Py} Ⓑ e^{Px} Ⓒ $e^{\int Pdx}$ Ⓓ $e^{\int Pdy}$

[Hints : Linear differential equation 2^{nd} form.]

SECTION – B

Very Short Answer (VSA) (2 marks each questions):

1. Prove that, $x = A\cos\sqrt{\mu}t$ is a solution of the differential equation $\frac{d^2x}{dt^2} + \mu x = 0$.

[Hints : Verification of differential equation.]

2. Show that the differential equation $\frac{dy}{dx} = y$ is formed by eliminating a and b from the relation $y = ae^{b+x}$.

[Hints : Elimination of arbitrary constants]

3. Solve: $\frac{dy}{dx} = 1 - x + y - xy$

[Hints : Variable separable.]

4. Solve: $dx - dy + ydx + xdy = 0$.

[Hints : d(xy) = xdy + ydx]

5. Find the differential equation of the family of circles $x^2 + y^2 = 2ax$, where a is a parameter.

[Hints : Eliminating a by differentiating both sides w.r.t x one.]

6. Form the differential equation representing the family of curves $y = A\cos(x + B)$, where a and B are parameters.

[Hints : Formation of differential equation.]

7. Show that $V = \frac{A}{r} + B$ satisfies the differential equation $\frac{d^2V}{dr^2} + \frac{2}{r}.\frac{dv}{dr} = 0$.

[Hints : Formation of differential equation from the given equation.]

SECTION – C

Short Answer (SA) (3 marks each questions):

1. Form the differential equation by eliminating a and b $x = e^{-t}(a\cos t + b\sin t)$.

[Hints : Formation of differential equation.]

2. Solve: $(ax + hy + g)dx + (bx + by + f)dy = 0$

[Hints : Homogeneous differential equation.]

3. Show that, the general solution of the equation $dy = y\log y\,dx$ is $y = C\left(\frac{x}{e}\right)^x$, where e is arbitrry constant.

[Hints : Variable separable.]

4. Solve: $(x^2y^3 + 2xy)\,dy = dx$

[Hints : Linear differential equation.]

5. $\frac{dy}{dx} = \frac{x\sqrt{x^2-1} + y}{\sqrt{x^2-1}}$; $y = 1, x = 1$

[Hints : Linear differential equation.]

6. A particle starts with the velocity v and moves in a straight line, its acceleration being always equal to its displacement. If v be the velocity when its displacement is x, then show that, $v^2 = u^2 + x^2$.

[Hints : Application of differential equation.]

7. $x^2 + y^2 = \log(y\,dy) - \log(x\,dx)$

[Hints : Variable separable]

SECTION – D

Long Answer (LA) (5 marks each questions):

1. Solve: $\frac{dy}{dx} + \frac{y}{(1-x^2)^{3/2}} = \frac{x + \sqrt{1-x^2}}{(1-x^2)^2}$

[Hints : Linear differential equation.]

2. Solve: $(1 + \tan y)(dx - dy) + 2x\,dy = 0$

[Hints : Linear form.]

3. A curve passes through the point (2, 0) and satisfies the equation $y\,dy + x\,dx = 0$, show that the curve is a circle with radius 2 unit.

[Hints : Application of differential equation.]

4. The marginal cost function of manufacturing x pairs of shoes is ₹$(6 + 10x - 6x^2)$. The total cost of producing a pair of shoes is ₹12. Find the total and average cost function.

[Hints : Application of differential equation.]

5. Solve: $\frac{dy}{dx} = \frac{x+y}{x}$; $y(1) = 1$

[Hints : Homogeneous differential equation.]

6. The solution of the equation $\frac{d^2y}{dx^2} = e^{-2x}$.

[Hints : Concept of integration.]

7. Solve: $(1+x^2)\frac{dy}{dx} + 2xy = 4x^2$, $y(0) = 0$

[Hints : Linear differential equation.]

ANSWER

MCQs →

1. Ⓑ
2. Ⓐ
3. Ⓐ
4. Ⓐ
5. Ⓑ
6. Ⓒ
7. Ⓓ

VSA →

3. $\log|x + y| = x - \frac{x^2}{2} + C$
4. $(x - 1)^2 (y + 1)^2 = C$
5. $2xy\frac{dy}{dx} = y^2 - x^2$
6. $\frac{d^2y}{dx^2} + y = 0$

SA →

1. $\dfrac{d^2x}{dt^2} + 2\dfrac{dx}{dt} + 2x = 0$
2. $ax^2 + 2hxy + by^2 + 2gx + 2fy + C = 0.$
4. $\dfrac{1}{x} = \dfrac{1}{2}(1 - y^2) + Ce^{-y^2}$
5. $y\left(x - \sqrt{x^2 - 1}\right) = \dfrac{1}{3}\left[\left(x^3 - (x^2 - 1)^{\frac{3}{2}}\right) + \dfrac{2}{3}\right]$
7. $e^{x^2} + e^{-y^2} + C = 0$

LA →

1. $y = \dfrac{x}{\sqrt{1 - x^2}} + C.e^{-\frac{x}{\sqrt{1-x^2}}}$
2. $(\cos y + \sin y)x = \sin y + Ce^{-y}$
3. 2 unit
4. ₹$(3 + 6x + 5x^2 - 2x^3)$ and $(6 + 5x - 2x^2 + \dfrac{3}{x})$
5. $x|hx + x$
6. $\dfrac{e^{-2x}}{4} + Cx + d$
7. $3(1 + x^2)\, y = 4x^3$