PRACTICE PAPER 01 (2026-27)
CHAPTER 09 : DIFFERENTIAL EQUATIONS

SUBJECT: MATHEMATICS	**MAX. MARKS:** 40
CLASS: XII	**DURATION:** 1½ hrs

General Instructions:

(i) All questions are compulsory.

(ii) This question paper contains 20 questions divided into five Sections A, B, C, D and E.

(iii) Section A comprises 10 MCQs of 1 mark each (Q9 and Q10 are Assertion–Reason questions). Section B comprises 4 questions of 2 marks each. Section C comprises 3 questions of 3 marks each. Section D comprises 1 question of 5 marks with an internal choice. Section E comprises 2 case study based questions of 4 marks each, with internal choice in the last sub-part.

(iv) There is no overall choice. Internal choices have been provided where indicated.

(v) Use of calculators is not permitted.

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=\frac{d^2y}{dx^2}$ are respectively

(a) 2, 3 (b) 2, 2 (c) 2, 3/2 (d) 1, 2

2. The solution of the differential equation $\frac{dy}{dx}=e^{x-y}$ is

(a) $e^y = e^x + C$ (b) $e^{-y} = e^x + C$ (c) $y = e^x + C$ (d) $e^x + e^y = C$

3. The number of arbitrary constants in the general solution of a third order differential equation is

(a) 1 (b) 2 (c) 3 (d) 4

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

(a) e^{2x} (b) 2x (c) $1/x^2$ (d) x^2

5. The differential equation representing the family of curves $y = Ae^{2x}$ (A arbitrary) is

(a) dy/dx = y/2 (b) dy/dx = 2x (c) dy/dx = 2y (d) $d^2y/dx^2 = 2y$

6. For the homogeneous equation $\frac{dy}{dx}=\frac{x+2y}{x}$, the substitution y = vx reduces it to $x\frac{dv}{dx}=$

(a) 1 + v (b) 1 (c) 1 + 2v (d) v

7. The particular solution of dy/dx = 2x satisfying y(0) = 3 is

(a) $y = x^2 + 3$ (b) $y = x^2$ (c) y = 2x + 3 (d) $y = x^2 - 3$

8. The general solution of x dy + y dx = 0 is

(a) x + y = C (b) x/y = C (c) $x^2 + y^2 = C$ (d) xy = C

For Q9 and Q10, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

9. Assertion (A): The general solution of dy/dx = 3 is y = 3x.

Reason (R): The general solution of an n^{th} order differential equation contains n arbitrary constants.

10. Assertion (A): The integrating factor of the linear equation dy/dx + Py = Q is $e^{\int P\,dx}$.

Reason (R): The solution of this equation is $y \cdot \text{I.F.} = \int Q \cdot \text{I.F.}\, dx + C$.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Find the order and degree of the differential equation $\left(y - x\frac{dy}{dx}\right)^2 = 1 + \left(\frac{dy}{dx}\right)^2$.

12. Form the differential equation representing the family of parabolas $y^2 = 4ax$, where a is an arbitrary constant.

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

14. Solve: $\frac{dy}{dx} = y\tan x$.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Find the particular solution of $\frac{dy}{dx} = 3x^2e^{-y}$, given that y = 0 when x = 0.

16. Solve the differential equation $(x^2 + y^2)\,dx = 2xy\,dy$.

17. Solve: $\frac{dy}{dx} + 2y = e^{-x}$.

SECTION – D

Question 18 carries 5 marks.

18. Find the particular solution of the differential equation $x\log x\frac{dy}{dx} + y = 2\log x$, given that y = 2 when x = e.

OR

Solve the differential equation $x\,dy - y\,dx = \sqrt{x^2 + y^2}\,dx$.

SECTION – E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. In a laboratory, a bacterial culture grows at a rate proportional to the number N of bacteria present at time t (in hours). Initially there are 1000 bacteria and after 2 hours there are 2000.

Based on the above information, answer the following questions:

(i) Write the differential equation for the growth of the culture. (1)

(ii) Solve it to obtain the general solution. (1)

(iii) Find the number of bacteria after 6 hours. (2)

OR

(iii) After how many hours will the number of bacteria be 16000? (2)

20. A ball of mass 1 kg falls from rest through air. Its velocity v (in m/s) at time t seconds satisfies the equation $\frac{dv}{dt} = 10 - 0.2\,v$ with v = 0 at t = 0.

Based on the above information, answer the following questions:

(i) Write the equation in the form dv/dt + Pv = Q and find the integrating factor. (1)

(ii) Find the general solution. (1)

(iii) Find the particular solution and the terminal velocity, i.e. the value of v as t → ∞. (2)

OR

(iii) Using v = 0 at t = 0, find the time at which the velocity becomes 25 m/s. (2)

— End of Question Paper —