Class 12 Mathematics — Practice Set

Board Exam Pattern | Theory Paper

Maximum Marks: 80 **Time Allowed: 3 Hours**

General Instructions

1. All questions are compulsory. The paper has five sections: A, B, C, D and E.
2. Section A: 1-mark questions (MCQ / Assertion-Reason). Section B: 2-mark questions. Section C: 3-mark questions. Section D: 5-mark questions. Section E: 4-mark case-based questions.
3. Internal choice is provided in some questions of Sections B-E — attempt only one of the choices.
4. Use of calculators is not permitted.
5. This is a practice set for self-assessment; always cross-check the latest pattern with your board's official sample paper.

SECTION A

Questions 1 to 20 carry 1 mark each.

1. If A is a square matrix of order 3 and |A| = 5, then |2A| equals (a) 10 (b) 40 (c) 80 (d) 5

2. The principal value of $\sin^{-1}(1/2)$ is (a) π/6 (b) π/3 (c) π/2 (d) π/4

3. The function f(x) = |x| is (a) differentiable everywhere (b) continuous everywhere but not differentiable at x = 0 (c) discontinuous at x = 0 (d) nowhere continuous

4. ∫ (1/x) dx equals (a) x + C (b) log|x| + C (c) $-1/x^2$ + C (d) 1 + C

5. The derivative of e^x with respect to x is (a) e^x (b) $x\,e^{x-1}$ (c) e^x/x (d) 1

6. The order of the differential equation $d^2y/dx^2 + 3(dy/dx)^3 + y = 0$ is (a) 1 (b) 2 (c) 3 (d) 0

7. If vectors a and b are perpendicular, then a · b equals (a) |a||b| (b) 0 (c) 1 (d) −|a||b|

8. The direction cosines of the x-axis are (a) 1, 1, 1 (b) 1, 0, 0 (c) 0, 1, 0 (d) 0, 0, 1

9. For two events A and B, P(A ∩ B) = P(A)·P(B) holds when A and B are (a) mutually exclusive (b) independent (c) equally likely (d) exhaustive

10. The maximum value of an LPP objective function occurs at (a) the origin always (b) a corner point of the feasible region (c) the centre of the region (d) any interior point

11. A relation R on a set A is an equivalence relation if it is (a) reflexive only (b) symmetric only (c) reflexive, symmetric and transitive (d) transitive only

12. If A is a 2×3 matrix and B is a 3×2 matrix, then AB is of order (a) 2×2 (b) 3×3 (c) 2×3 (d) not defined

13. $\int_0^{\pi/2} \sin x\, dx$ equals (a) 0 (b) 1 (c) π/2 (d) −1

14. The slope of the tangent to the curve $y = x^2$ at the point (1, 1) is (a) 1 (b) 2 (c) 0 (d) 1/2

15. If P(A) = 0.6, then P(not A) equals (a) 0.6 (b) 0.4 (c) 1 (d) 0

16. The value of the determinant of the matrix [[2, 0], [0, 3]] is (a) 0 (b) 5 (c) 6 (d) 1

17. The integrating factor of the differential equation $dy/dx + y = e^x$ is (a) e^x (b) e^{-x} (c) x (d) 1

18. If a = 2i + 3j, then |a| equals (a) 5 (b) √13 (c) 13 (d) √5

19. Assertion (A): The function $f(x) = x^3$ is increasing on R. Reason (R): $f'(x) = 3x^2 \geq 0$ for all x. (a) Both A and R true, R explains A (b) Both true, R does not explain A (c) A true, R false (d) A false, R true

20. Assertion (A): Every differentiable function is continuous. Reason (R): Continuity implies differentiability. (a) Both A and R true, R explains A (b) Both true, R does not explain A (c) A true, R false (d) A false, R true

SECTION B

Questions 21 to 25 carry 2 marks each.

21. Find the principal value of $\cos^{-1}(-1/2)$.

22. If A = [[1, 2], [3, 4]], find $A + A^T$.

23. Differentiate $\sin(x^2)$ with respect to x.

24. Evaluate $\int (2x + 1)\, dx$.

25. Find the angle between the vectors a = i + j and b = i − j.

SECTION C

Questions 26 to 31 carry 3 marks each.

26. Show that the function $f(x) = 2x^3 - 3x^2 - 12x + 5$ is decreasing on the interval (−1, 2).

27. Evaluate $\int x e^x\, dx$ using integration by parts.

28. Find the general solution of the differential equation $dy/dx = (1 + y^2) / (1 + x^2)$.

29. If A = [[2, 3], [1, 4]], find A^{-1}.

30. Find the vector equation of the line passing through the point (1, 2, 3) and parallel to the vector 2i + 3j + 6k.

31. A bag contains 4 red and 6 black balls. Two balls are drawn at random without replacement. Find the probability that both are red.

SECTION D

Questions 32 to 35 carry 5 marks each. Internal choice provided.

32. (a) Evaluate $\int_0^{\pi/2} (\sin x) / (\sin x + \cos x)\, dx$. OR (b) Find the area of the region bounded by the curve $y = x^2$ and the line y = 4.

33. (a) Solve the system of equations using matrices: x + y + z = 6, y + 3z = 11, x − 2y + z = 0. OR (b) If A = [[1, 1, 1], [1, 2, 3], [1, 4, 9]], find A^{-1} and hence comment on its use in solving linear systems.

34. (a) Solve the LPP: Maximise Z = 5x + 3y subject to 3x + 5y ≤ 15, 5x + 2y ≤ 10, x ≥ 0, y ≥ 0. OR (b) Maximise Z = 4x + y subject to x + y ≤ 50, 3x + y ≤ 90, x ≥ 0, y ≥ 0.

35. (a) Find dy/dx if $y = x^x$. OR (b) Verify that $y = e^x(\sin x + \cos x)$ is a solution of the differential equation $d^2y/dx^2 - 2\, dy/dx + 2y = 0$.

SECTION E

Questions 36 to 38 are case-based, carrying 4 marks each.

36. Case study. A manufacturer models the daily profit (in thousand rupees) from producing x units as $P(x) = -x^2 + 40x - 100$. (i) Write P′(x). (ii) Find the number of units that maximises profit. (iii) Find the maximum daily profit. (iv) State whether P(x) is increasing or decreasing at x = 25.

37. Case study. The probability that a student passes Mathematics is 0.8 and the probability that the same student passes Physics is 0.7. The two events are independent. (i) Find the probability the student passes both subjects. (ii) Find the probability the student passes at least one subject. (iii) Find the probability the student passes neither. (iv) Find the probability the student passes Maths but not Physics.

38. Case study. A drone flies in a straight line whose vector equation is r = (i + 2j + 3k) + λ(2i + j + 2k). (i) Write the position vector of a point on the line. (ii) Write the direction vector of the line. (iii) Find a point on the line corresponding to λ = 1. (iv) Find the magnitude of the direction vector.