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CLASS 12

Mathematics

Sample Paper 4 - Questions

38 questions | 80 marks | 2026-27

Time: 3 hours. Answer all questions and subparts unless a choice is stated. Marks are shown on the right. Write answers on separate sheets. Independently prepared practice paper.

Section A - Objective questions

1. Calculate the dot product of (30,2,1) and (2,30,3). **1**
(A) 123 (B) 124 (C) 122 (D) 125

2. Determine the value of the integral from 0 to 1 of $93x^2$ dx. **1**
(A) 31 (B) 32 (C) 30 (D) 33

3. Calculate the determinant of [[33,1],[1,34]]. **1**
(A) 1120 (B) 1122 (C) 1123 (D) 1121

4. Calculate the area of the parallelogram spanned by (27,0,0) and (0,29,0). **1**
(A) 785 (B) 782 (C) 784 (D) 783

5. A bag contains 30 red and 31 blue balls. Two are drawn without replacement. Given the first was red, find the probability the second is blue. **1**
(A) -29/60 (B) 31/60 (C) 151/60 (D) 91/60

6. For cost $C(x) = x^2 + 62x + 100$, find marginal cost C'(5). **1**
(A) 74 (B) 72 (C) 73 (D) 71

7. f(x) = cx + 1 for x < 2 and f(x) = 63 for x >= 2. Calculate c for continuity at x = 2. **1**
(A) 33 (B) 31 (C) 30 (D) 32

8. How many ordered pairs belong to A x A if set A has 33 elements? **1**
(A) 1088 (B) 1091 (C) 1090 (D) 1089

9. For $f(x) = 28x^3$, calculate $f'(2)$. 1
(A) 338 (B) 336 (C) 337 (D) 335

10. Given $dy/dx = 62x$ and $y(0) = 30$, find $y(1)$. 1
(A) 63 (B) 60 (C) 62 (D) 61

11. A and B produce equal quantities. Their defect probabilities are 0.01 and 0.03 respectively. Given an item is defective, find the probability it came from B. 1
(A) 11/4 (B) 7/4 (C) -1/4 (D) 3/4

12. A line has direction ratios 1, 2, 2. Calculate the cosine of its acute angle with the x-axis. 1
(A) 4/3 (B) 7/3 (C) 1/3 (D) -2/3

13. Determine the value of sin inverse(0) + cos inverse(1) + tan inverse(0), using principal values. 1
(A) 0 (B) 1 (C) 2 (D) -1

14. Determine the value of the integral from 0 to 1 of $84x^2$ dx. 1
(A) 30 (B) 28 (C) 27 (D) 29

15. Calculate the area of the parallelogram spanned by (32,0,0) and (0,34,0). 1
(A) 1090 (B) 1089 (C) 1087 (D) 1088

16. How many ordered pairs belong to A x A if set A has 29 elements? 1
(A) 840 (B) 842 (C) 843 (D) 841

17. A bag contains 34 red and 35 blue balls. Two are drawn without replacement. Given the first was red, find the probability the second is blue. 1
(A) 103/68 (B) -33/68 (C) 35/68 (D) 171/68

18. Calculate the dot product of (26,2,1) and (2,26,3). 1
(A) 109 (B) 107 (C) 106 (D) 108

19. $f(x) = cx + 1$ for $x < 2$ and $f(x) = 55$ for $x >= 2$. Calculate c for continuity at $x = 2$. 1
(A) 26 (B) 28 (C) 29 (D) 27

20. Calculate the determinant of [[29,1],[1,30]]. 1
(A) 869 (B) 868 (C) 871 (D) 870

Section B - Short responses

21. For cost $C(x) = x^2 + 58x + 100$, find marginal cost C'(5). 2

22. Given dy/dx = 56x and y(0) = 27, find y(1). 2

23. For $f(x) = 29x^3$, calculate f'(2). 2

24. Calculate the area of the parallelogram spanned by (31,0,0) and (0,33,0). 2

25. f(x) = cx + 1 for x < 2 and f(x) = 59 for x >= 2. Calculate c for continuity at x = 2. 2

Section C - Short responses

26. A finite set A has 32 elements. Calculate n(A×A), then determine the number of functions from A to {0,1}. Justify both counts. 3

27. For A=[[31,1],[1,32]], calculate det(A). Hence find A inverse and justify why the inverse exists. 3

28. Solve dy/dx=54x with y(0)=26. State y(1) and verify the equation and initial condition. 3

29. For u=(28,2,1) and v=(2,28,3), find u·v, both magnitudes and the cosine of their included angle. 3

30. For cost $C(x) = x^2 + 52x + 100$, find marginal cost C'(5). Also calculate C(6)−C(5) and compare it with C'(5). Explain the difference between a derivative and this finite change. 3

31. For $f(x)=32x^3$, determine f'(x). Calculate the equation of the tangent at x=2, showing the point and slope used. 3

Section D - Extended responses

32. Determine the value of the integral from 0 to 1 of $(3x^2 + 2x + 1)\,dx$. Separately find the area between $y = x$ and $y = x^2$ on $[0, 1]$. **5**

33. Derive the total-probability expression $P(D) = P(A)P(D|A) + P(B)P(D|B)$ when A and B form a partition with positive probabilities. **5**

34. Demonstrate that if A is invertible and $AX = B$, then $X = A^{-1}B$. Explain why multiplication order matters. **5**

35. For $A = [[2, 1], [1, 3]]$, find $\det(A)$ and A^{-1}. Use the inverse to solve $2x + y = 7$ and $x + 3y = 11$. **5**

Section E - Case and application questions

36. A production model has cost $C(x)=x^2-16x+94$, $x\geq 0$.

(a) Find $C(0)$. **1**

(b) Find marginal cost. **1**

(c) Determine and justify the minimum-cost output and minimum cost. **2**

37. Adjacent displacement vectors are $u=(6,0,0)$ and $v=(0,8,0)$.

(a) Find $u\cdot v$. **1**

(b) Find $|u|$. **1**

(c) Find the area of the triangle they form, explaining the factor used. **2**

38. A factory receives 70% of items from A and the rest from B. Their defect rates are 2% and 5% respectively.

(a) Find P(A and defective). **1**

(b) Find the overall defect probability. **1**

(c) Given an item is defective, find the probability it came from B. **2**

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