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| **FT/MAQP/1223/B 14-JUN-2023** | | | | | |
| **FIRST TERM EXAMINATION (2023-24)** | | | | | |
| **Subject: Mathematics**  **Grade: 12** | | | Max. Marks: 80Time: 3 Hr | | |
| General Instructions:  1. This Question paper contains - five sections A, B, C, D and E. Each section is  compulsory.  2. Section A has 18 MCQ’s and 02 Assertion-Reason based questions of 1 mark each.  3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.  4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.  5. Section D has 4 Long Answer (LA)-type questions of 5 marks each  6.Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts  7. All Questions are compulsory. | | | | | |
|  | **Section-A** | | | | |
| ***Each Question is of 1 mark weightage.*** | | | | | |
|  | If denotes the set of all real numbers, then the function defined by is | | | | |
|  | **a.** | One-one only | | **b.** | Onto only |
|  | **c.** | Both one-one and onto | | **d.** | Neither one-one nor onto |
| **2.** | If be a relation defined as iff , then the relation is | | | | |
|  | **a.** | Reflexive | | **b.** | Symmetric |
|  | **c.** | Transitive | | **d.** | Symmetric and transitive |
| **3.** | On the set of integers , define as , then is | | | | |
|  | **a.** | Injective but not surjective | | **b.** | Neither injective nor surjective |
|  | **c.** | Surjective but not injective | | **d.** | Bijective |
| **4.** | is equal to | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
| **5.** |  | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** | None of these |
|  |  |  | |  |  |
|  |  |  | |  |  |
| 6. | The value of is | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
| 7. | is equal to | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
| 8. | If then | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
| 9. | Ifthan the values of , and are respectively | | | | |
|  | **a.** | 5, 2, 2 | | **b.** | 1, -2, 3 |
|  | **c.** | 0, -3, 3 | | **d.** | 11, 8, 3 |
| 10. | If A=and, then equals | | | | |
|  | **a.** | 2 | | **b.** |  |
|  | **c.** | 1 | | **d.** |  |
| 11. | The value of the determinant is equal to | | | | |
|  | **a.** | - 4 | | **b.** | 0 |
|  | **c.** | 1 | | **d.** | 4 |
| 12. | is a square matrix of order 4 and is a unit matrix, then it is true that | | | | |
|  | **a.** | etet | | **b.** | detdet |
|  | **c.** | detdet | | **d.** | det |
| 13. | The matrix is a singular matrix, if is equal to | | | | |
|  | **a.** | - 3 | | **b.** | 3 |
|  | **c.** | 0 | | **d.** | For any value of b |
| 14. | is continuous for | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** | Only | | **d.** | No value of |
| 15. | If then at is equal to | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
| 16. | If y + sin y = cos x, then is | | | | |
|  | **a.** |  | | **b.** |  |
|  | **c.** |  | | **d.** |  |
|  |  |  | |  |  |
| 17. | Which of the following functions is decreasing on (0, π/2) | | | | |
|  | **a.** | Sin 2x | | **b.** | Tan x |
|  | **c.** | Cos x | | **d.** | Cos 3x |
| 18. | Find the interval in which the function f(x) = x2 – 4x + 5 is increasing : | | | | |
|  | **a.** | (2, ) | | **b.** | ( -) |
|  | **c.** | (3, ) | | **d.** | (-, ) |
|  | **ASSERTION-REASON BASED QUESTIONS**  In the following questions, 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. | | | | |
| 19. | Assertion (A): f(x)=[x] greatest integer function is not differentiable at x=2  Reason (R): The greatest integer function is not continuous at any integer | | | | |
| 20. | Assertion (A): The function f(x) = x3 – 3x2 + 6x – 100 is strictly increasing on R  Reason (R): If f ’(x) 0 , then f(x) is strictly increasing function. | | | | |
|  | **Section-B (2 Marks)** | | | | |
| 21. | Find the value of the constant k so that the function given below is continuous at x = 0 | | | | |
| 22. | Evaluate : | | | | |
| 23. | If A = , then show that A2 – 5A + 7I = 0 | | | | |
| 24. | Solve for x: | | | | |
| 25. | Find an angle θ, 0 which increases twice as fast as its sine. | | | | |
|  | **Section-C (3 Marks)** | | | | |
| 26. | Show that each of the relation R in the set A = {x ∈ Z : 0 ≤ x ≤ 12}, given by R = {(a, b): |a – b| is a multiple of 4} is an equivalence relation. Find the set of all elements related to 1. | | | | |
| 27. | and  and , then find a and b. | | | | |
| 28. | Let A = Express A as sum of two matrices such that one is symmetric and the other is skew symmetric. | | | | |
| 29. | If , prove that | | | | |
| 30. |  | | | | |
| 31. | Find the intervals in which the function f(x) = (x - 1)3 (x - 2)2 is   1. increasing 2. decreasing. | | | | |
|  | **Section-D (LA-5Marks)** | | | | |
| 32 | Let N denote the set of all natural numbers and R be the relation on N x N defined by . Show that R is an equivalence relation on N x N | | | | |
| 33 | If | | | | |
| 34 | If | | | | |
| 35 | Using matrices, solve the following system of linear equations:  2x - y +z = 3, -x + 2y - z = - 4, x - y + 2z = 1 | | | | |
|  | **Section-E (CASE STUDY-4 Marks)** | | | | |
| 36. | A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi-vertical angle is tan–1 (0.5). Water is poured into it at a constant rate of 5 cubic meters per hour.   1. Find the expression for volume in terms of depth. 2. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 4 m. | | | | |
| 37. | Three schools A , B and C organized a mela for collecting funds for helping the rehabilitation of flood victims. They sold handmade fans, mats and plates from recycled material at a cost of ₹25, ₹100 and ₹50 each. The number of articles sold are given below:   |  |  |  |  | | --- | --- | --- | --- | | **School**    **Article** | **A** | **B** | **C** | | **Hand fans** | 40 | 25 | 35 | | **Mats** | 50 | 40 | 50 | | **Plates** | 20 | 30 | 40 |  1. Find the funds collected by each school separately by selling the above articles. 2. Also find the total funds collected for the purpose. | | | | |
| 38. | Let  and Y = range (f). Show that:  i)f is one-one ii)f is onto. | | | | |

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