KENDRIYA VIDYALAYA SANGATHAN LUCKNOW REGION

Class: -XII Session 23-24

2nd PRE BOARD

Mathematics (Code-041)

Time: 3 hours **Maximum marks: 80**

General Instructions:

1. This Question paper contains - five sections **A, B, C, D** and **E**. Each section is compulsory. However, there are internal choices in some questions.
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** of 4 marks each with sub-parts.

Section–A

(Multiple Choice Questions)

Each question carries 1 mark

Q1. If A is a matrix of order m × n and B is a matrix such that AB^T *and* B^TA both are defined, then the order of matrix B is

a) m × m b) n × n c) m × n d) n × m

Q2. If A is a square matrix such that $A^2 - A + I = O$ then the inverse of A is

a) $I - A$ b) $A - I$ c) A d) $I + A$

Q3. If |2 3 2 x x x 4 9 1 | $+ 3 = 0$ then find the value of x is

a) 3 b) 0 c) -1 d) 1

Q4. The function $f(x) = |x| + |x - 1|$ is

a) continuous at $x = 0$ as well as at $x = 1$ b) continuous at $x = 1$ but not at $x = 0$

c) discontinuous at $x = 0$ as well as at $x = 1$ d) continuous at $x = 0$ but not at $x = 1$

Q5. If a line make angle α ,β , and γ with the coordinate axis respectively, then

$+ \quad + \quad =$

a) 1 b) 2 c) -1 d) -2

Q6. The degree of the differential equation $\left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{\frac{3}{2}} = \frac{d^2y}{dx^2}$ is

a) 4 b) 3/2 c) not defined d) 2

Q7. If the constraints in a linear programming problem are changed

a) the problem is to be re-evaluated b) the solution is not defined

c) the objective function has to be modified c) the change in constraints is ignored

Q8. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vector such that $\vec{a} + \vec{b} + \vec{c} = 0$ then vector of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$ is

a) 1 b) 2/3 c) -3/2 d) 2

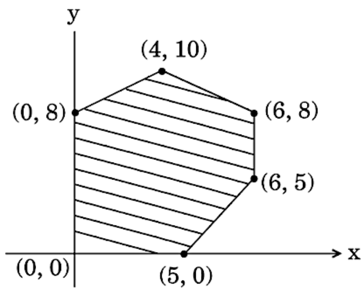
Q9. The value of the integral $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos cos\, x \log log \left(\frac{1+x}{1-x}\right) dx$ is

a) 0 b) 1/2 c) -1/2 d) none of these

Q10. If A and B are square matrices of order 3 x 3 such that | A | = 5 and | B | = 3 then | 3AB | =

a) 135 b) 45 c) 405 d) none of these

Q11. The feasible region for an LPP is shown in fig, let $z = 3x - 4y$ be the objective function. minimum of Z occurs at



a) (0,0) b) (5, 0) c) (0, 8) d) (6, 5)

Q12. The area of the parallelogram whose adjacent sides are $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ is

a) √2 b) √3 c) 3 d) 4

Q13. If for a matrix A, |A| = 6 and adj A = $[1\ \ -2\ 4\ 4\ 1\ 1\ \ -1\ k\ 0\,]$, then k is equal to

a) -1 b) 0 c) 1 d) 2

Q14. In a college, 30% students fail in physics, 25% fail in mathematics and 10% fail in both. One student is chosen at random. The probability that she fails in physics if she fails in mathematics is

a) 1/10 b) 2/5 c) 9/20 d) 1/3

Q15. Solution of the differential equation $\tan tan\, yx\, dx + \tan tan\, xy\, dy = 0$ is

a) $\tan tan\, x + \tan tan\, y = k$ b) $\tan tan\, x - \tan tan\, y = k$

c) $\frac{tanx}{tany} = k$ d) $\tan tan\, x \tan tan\, y = k$

Q16. The projection of the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ along the vector $\vec{b} = \hat{j}$

a) 1 b) 0 c) 2 d) -1

Q17. If $f(x) = \{ax^2 + 1,\ x > 1\ x + a,\ x \leq 1$ is derivable at $x = 1$ then the value of a is

a) 0 b) 1 c) 1/2 d) 2

Q18. The coordinate of the foot of the perpendicular drawn from point P (2, 3, 6) on xy-plane are

a) (-2, 3, 0) b) (0, 3, 6) c) (-2, 0, 6) d) (2, 3, 0)

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

Q19. **Assertion (A):** The rate of change of the area with respect to radius to radius is equal to C.
Reason (R): the rate of change of the area with respect to diameter is C/2

Q20. **Assertion (A):** the function $f: R \rightarrow R$ defined by $f(x) = x^3 + 4x - 5$ is a bijection.
Reason (R): Every odd degree Polynomial has at least one real root.

Section –B

[This section comprises of very short answer type questions (VSA) of 2 marks each]

Q21. Find the value of $22 + \left(\frac{1}{2}\right)$.

OR

Find the Principal Value of $\{\cos cos \left(-\ 680^o\right)\}$.

Q22. Find the intervals in which the following functions $-2x^3 - 9x^2 - 12x + 1$ are strictly Decreasing.

Q23. Evaluate $\int \frac{coscos\ 2x - \emptyset}{coscos\ x - coscos\ \emptyset}\, dx$

Q24. Show that the function given by $f\ (x) = \frac{logx}{x}$ has maximum at x = e.

OR

Find local maximum and local minimum values of the function f given by

$f(x) = 3x^4 + 4x^3 - 12x^2 + 12$

Q25. Determine the critical points of the function $f(x) = 2x^3 - 15x^2 + 36x - 3$.

Section – C

[This section comprises of short answer type questions (SA) of 3 marks each]

Q26. Let X denote the number of hours you study during a randomly selected school day. The probability that X can take the values x, has the following form, where k is some unknown constant.

$$P(X = x) = \begin{cases} 0.1, \text{ if } x = 0 \\ kx, \text{ if } x = 1 \text{ or } 2 \\ k(5-x), \text{ if } x = 3 \text{ or } 4 \\ 0, \text{ otherwise} \end{cases}$$

1. (a) Find the value of k.
2. (b) What is the probability that you study at least two hours ?
3. (c) What is the probability that you study at most two hours?

Q27. Evaluate $\int \frac{5x+3}{\sqrt{x^2+4x+10}} dx$

Q28. Solve the differential equation $(y - x)dy = (1 + y2)dx$.

OR

Show that the family of curves for which the slope of the tangent at any point (x, y) on it is $\frac{x^2+y^2}{2xy}$, is given by $x^2 - y^2 = cx$

Q29. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sin sin\, x + \cos cos\, x}{9+16 \sin sin\, 2x} dx$

OR

Evaluate $\int_0^4 (|x| + |x - 2| + |x - 4|)dx$

Q30. If $y = e^x,\ -1 \le x \le 1,\ show\ that (1 - x^2)\frac{(d^2y)}{dx^2} - x\frac{dy}{dx} - m^2y = 0$

Q31. Find the maximum value of $Z = 3x + 4y$ subjected to constraints $x + y \le 40,\ x + 2y \le 60,\ x \ge 0\ and\ y \ge 0.$

OR

Find the point where the minimum value of Z occurs : $Z = 2x + y$, subject to constraints

$3x + y \ge 9,$

$x + y \ge 7,$

$x + 2y \ge 8,$

$x \ge 0,\ y \ge 0.$

Section –D

[This section comprises of long answer type questions (LA) of 5 marks each]

Q32. Find the area under the curve $y = \sqrt{6x + 4}$ above x - axis from x = 0 to x = 2. Draw a sketch of curve also.

Q33. Let $A=\{1,2,3,...,9\}$ and R be the relation in $A \times A$ defined by $(a, b)\ R\ (c, d)$ if $a + d = b + c$ for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation. Also obtain the equivalence class $[(2, 5)]$.

OR

Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f: A \to B$ defined by $f(x) = \left(\frac{x-2}{x-3}\right)$.
Is f one-one and onto ? justify your answer

Q34. Use product $[1 \; -1 \; 2 \; 0 \; 2 \; -3 \; 3 \; -2 \; 4][-2 \; 0 \; 1 \; 9 \; 2 \; -3 \; 6 \; 1 \; -2]$ *to solve the system of equation*

$$x - y + 2z = 1$$

$$2y - 3z = 1$$

$$3x - 2y + 4z = 2$$

Q35. An aeroplane is flying along the line r =λ(i− j+k); where 'λ'is a scalar and another aeroplane is flying along the line r = i − j + μ(−2 j + k) ; where ' μ ' is a scalar. At what points on the lines should they reach, so that the distance between them is the shortest? Find the shortest possible distance between them.

OR

Find the image of the point (2, -1, 5) in the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$. Also find the equation of the line joining the given point and its image. find the length of that line segment also

Section –E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively. The third case study question has two sub parts of 2 marks each.)

Q36. He reliability of a COVID PCR test is specified as follows:
Of people having COVID, 90% of the test detects the disease but 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random, given the COVID PCR test, and the pathologist reports him/her as COVID positive

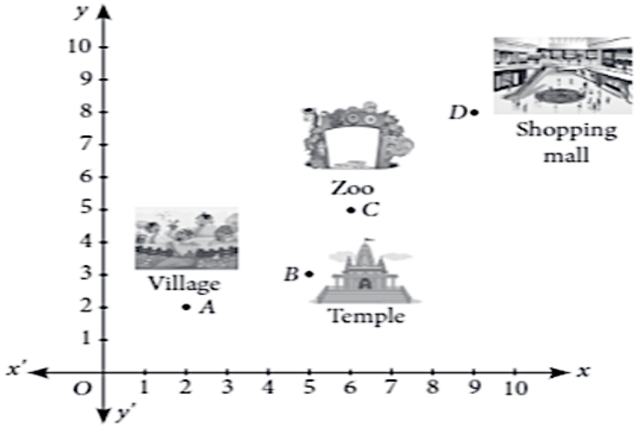
Based on the above information, answer the following

(i) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID?

(ii) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually not having COVID'?

(iii) What is the probability that the 'person is actually having COVID given that 'he is tested as COVID positive'?

Q37. Ishaan left from his village on weekend. First, he travelled up to the temple. After this , he left for the Zoo. After this, he left for shopping in a mall. The position of Ishaan at different Places is given in the following graph



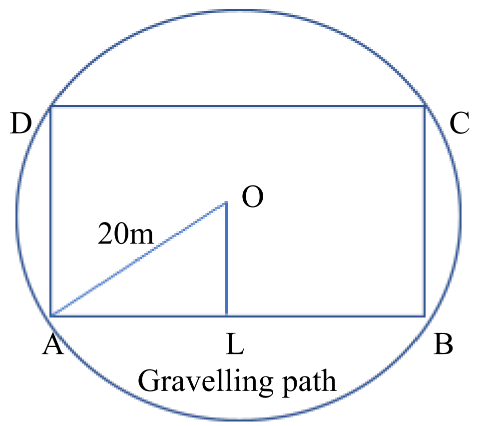
Based on the above information, answer the following

(i) find the position vector of B and D in term $\hat{i}$ & $\hat{j}$

(ii) find the length of vector $\vec{AD}$.

(iii) find the vector $\vec{BC}$. and if $\vec{M} = 4j + 3k$ then find the unit vector of $\vec{M}$.

Q38. An architect designs a garden in a residential complex. The garden is in the shape of a rectangle inscribed in a large circle of radius 20 m as shown in the following figure. If the length and breadth of rectangle garden are $2x$ *and* $2y$ meters respectively.



Based on the above information answer the following

(i) find the area A of the green grass of garden also find $\frac{dA}{dx}$

(ii) find the maximum area of the garden.

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