SET-2

Mock Exam:2025-26

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O.P. Code E/2/25

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Candidate must write the Q.P

Class – 12th

Xkf.kr &lSökfUrd

MATHEMATICS – Theory

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Time allowed: 3 hours	Maximum marks: 80

UkksV@NOTE:

(i)Ñi;k tkWap dj ysa fd bl iz"u & i= esa eqfnzr i`"B 13 gSaA

Please check that this question paper contains 13 printed pages.

(ii)Ñi;k tkWap dj ysa fd bl iz"u &i= esa 38 iz"u gSaA

Please check that this question paper contains 38 questions.

(iii)iz"u &i= esa nkfgus gkFk dh vksj fn, x, iz'u & i= dksM dks ijh{kkFkhZ mRrj iqfLrdk ds eq+[k &i`"B ij fy[ksaA

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) Ñi;k iz"u dk mRrj fy[kuk 'kq# djus ls igys] mRrj iqfLrdk esa iz'u dk Øekad vo'; fy[ksaA

Please write down the serial number of the question in the answer-book before attempting it.

(v) bl iz"u &i= dks i<us ds fy, 15 feuV dk le; fn;k x;k gSA iz"u &i= dk fooj.k iwokZâ es 9-15 cts fd;k tk,xkA 9-15 cts ls 9-30 cts rd Nk= dsoy iz'u & i= dks i<saxs vkSj bl vof/k ds nkSjku os mRRkj iqfLrdk ij dksbZ mRRkj ugha fy[ksaxsA

15 minutes time has been allotted to read this question paper. The question paper will be distributed at 9.15 a. m. From 9.15 a.m. to 9.30 a.m., the students will read the question paper only and will not write any answer on the answer – book during this period.

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This question paper contains **38** questions. **All** questions are **compulsory.**
2. This question paper is divided into **five** Sections - **A, B, C, D** and **E.**
3. In **Section A**, Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.
4. In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.
5. In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.
6. In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.
7. In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.
9. Use of calculator is not allowed.

SECTION-A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. Let both AB' and $B'A$ be defined for matrices A and B. If order of A is $n \times m$, then the order of B is

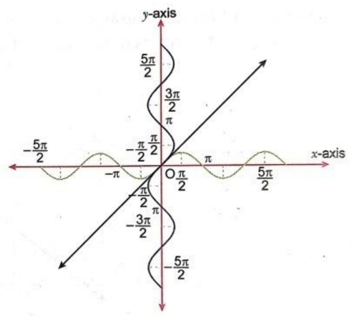
   (a) $n \times n$ (b) $n \times m$ (c) $m \times m$ (d) $m \times n$

2. If A $= \begin{bmatrix} -1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A is a/an:

   (a) Scalar matrix (b) identity matrix

   (c) Symmetric matrix (d) skew-symmetric

3. The following graph is a combination of



   (a) $y = sin^{-1} x$ and $y = cos^{-1} x$

   (b) $y = cos^{-1} x$ and $y = cos\, x$

   (c) $y = sin^{-1} x$ and $y = sin\, x$

   (d) $y = cos^{-1} x$ and $y = sin\, x$

4. Sum of two skew-symmetric matrices of same order is always a/an

   (a) Skew-symmetric matrix (b) symmetric matrix

   (c) Null matrix (d) identity matrix

5. $\left[sec^{-1}(-\sqrt{2}) - tan^{-1}\left(\frac{1}{\sqrt{3}}\right)\right]$ is equal to:

   (a) $\frac{11\pi}{12}$ (b) $\frac{5\pi}{12}$ (c) $-\frac{5\pi}{12}$ (d) $\frac{7\pi}{12}$

6. If f(x) = $\begin{cases} \frac{\log(1+ax)+\log(1-bx)}{x} & , for\ x \neq 0 \\ k & , for\ x = 0 \end{cases}$, is continuous at

x = 0, then the value of k is

(a) a (b) a + b (c) a – b (d) b

7. If $tan^{-1}(x^2 - y^2)$ = a, where 'a' is a constant, then $\frac{dy}{dx}$ is

(a) $\frac{x}{y}$ (b) - $\frac{x}{y}$ (c) $\frac{a}{x}$ (d) $\frac{a}{y}$

8. If y = a cos (log x) + b sin (log x), then $x^2y_2 + xy_1$ is

(a) Cot (log x) (b) y (c) – y (d) tan(log x)

9. Let f(x) = $|x|$, x ∈ ℝ. Then, which of the following statement is incorrect?

(a) f has a minimum value at x = 0

(b) f has no maximum value in ℝ

(c) f is continuous at x = 0

(d) f is differentiable at x = 0

10. Let f' (x) = 3(x^2 + 2x) - $\frac{4}{x^3}$ + 5, f(1) = 0 Then, f(x) is

(a) $x^3 + 3x^2 + \frac{2}{x^2} + 5x + 11$

(b) $x^3 + 3x^2 + \frac{2}{x^2} + 5x - 11$

(c) $x^3 + 3x^2 - \frac{2}{x^2} + 5x - 11$

(d) $x^3 - 3x^2 - \frac{2}{x^2} + 5x - 11$

11. $\int \frac{x+5}{(x+6)^2} e^x$ dx is equal to:

(a) log(x + 6) + C (b) e^x+ C

(c) $\frac{e^x}{x+6}$ + C (d) - $\frac{1}{(x+6)^2}$ + C

12. The order and degree of the differential equation

$-\frac{d^4y}{dx^4} + 2e^{\frac{dy}{dx}} + y^2 = 0$ are, respectively

(a) - 4, 1 (b) 4, not defined (c) 1, 1 (d) 4, 1

13. The solution for the diff equation log $\left(\frac{dy}{dx}\right) = 3x + 4y$ is

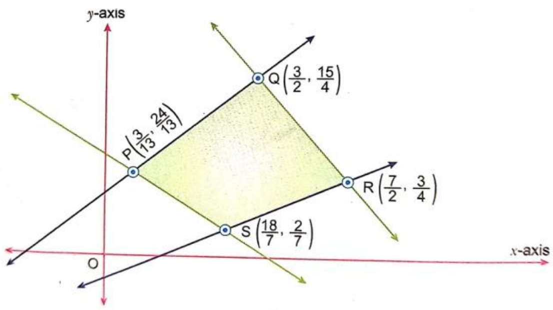
(a) $3e^{4y} + 4e^{-3x} + C = 0$

(b) $e^{3x+4y} + C = 0$

(c) $3e^{-3y} + 4e^{4x} + 12C = 0$

(d) $3e^{-4y} + 4e^{3x} + 12C = 0$

14. For a Linear Programming Problem (LPP), the given objective function is z = x + 2y The feasible region PQRS determined by the set of constraints is shown as a shaded region in the graph.



P = $\left(\frac{3}{13}, \frac{24}{13}\right), Q = \left(\frac{3}{2}, \frac{15}{4}\right), R = \left(\frac{7}{2}, \frac{3}{4}\right), S = \left(\frac{18}{7}, \frac{2}{7}\right)$

Which of the following statements is correct?

(a) Z is minimum at S $\left(\frac{18}{7}, \frac{2}{7}\right)$

(b) Z is minimum at R $\left(\frac{7}{2}, \frac{3}{4}\right)$

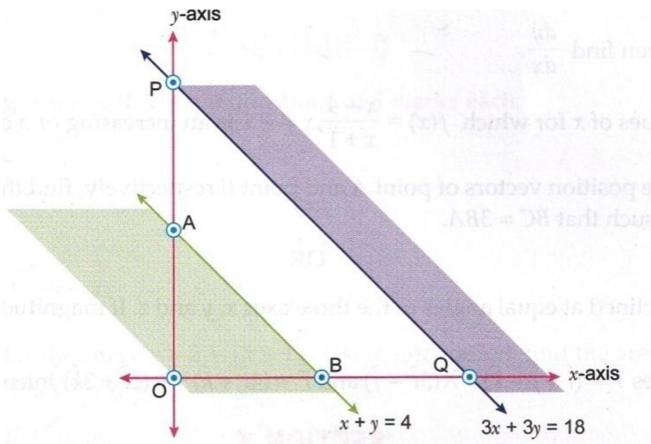
(c) (Value of Z at P) > (Value of Z at Q)

(d) (Value of Z at Q) < (Value of Z at R)

15. In a Linear Programming Problem (LPP), the objective function z = 2x + 5y is to be maximized under the following constraints:

$x + y \leq 4$, $3x + 3y \geq 18$; $x, y \geq 0$.

Study the graph and select the correct option:



The solution of the given LPP:

(a) Lies in the shaded unbounded region.

(b) Lies in ΔAOB

(c) Does not exist

(d) Lies in the combined region of ΔAOB and unbounded shaded region

16. Let $|\vec{a}| = 5$ and $-2 \leq \lambda \leq 1$. Then, the range of $|\overrightarrow{\lambda a}|$ is:

(a) [5, 10] (b) [- 2, 5] (c) [- 2, 1] (d) [0, 10]

17. The area of the region bounded by the curve y^2 = x between x = 0 and x = 1 is:

(a) $\frac{3}{2}$ sq. units (b) $\frac{2}{3}$ sq. units

(c) 3 sq. units (d) $\frac{4}{3}$ sq. units

18. A box has 4 green, 8 blue and 3 red pens. A student picks up a pen at random, checks its colour and replaces it in the box. He repeats this process 3 times. The probability that at least one pen picked was red is:

(a) $\frac{124}{125}$ (b) $\frac{1}{125}$ (c) $\frac{61}{125}$ (d) $\frac{64}{125}$

Direction: Question numbers 19 and 20 are Assertion (A) and Reason (R) based questions carrying 1 mark each. Two statements are given, one labeled Assertion (A) and other labeled Reason (R). Select the correct answer from the options given below.

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

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

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

19. **Assertion (A):** If $\left|\vec{a} \times \vec{b}\right|^2 + \left|\vec{a} . \vec{b}\right|^2 = 256\ and\ \left|\vec{b}\right| = 8,$ $then\ |\vec{a}| = 2.$

Reason (R) : $sin^2\theta + cos^2\theta = 1\ and\ \left|\vec{a} \times \vec{b}\right| = |\vec{a}|\left|\vec{b}\right|$ $\sin\theta$ and $\vec{a} . \vec{b} = |\vec{a}|\left|\vec{b}\right|\cos\theta$.

20. **Assertion:** Principal value of $sin^{-1}\left(sin\left(\frac{2\pi}{3}\right)\right)$ is $\frac{2\pi}{3}$.

Reason: Principal value branch of sin^{-1} function is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

SECTION-B

This section comprises 5 Very Short Answer (VSA) type questions of 2 marks each.

21. Find the domain of f(x) = $sin^{-1}(x^2 - 4)$.

22. (a) Differentiate $\sqrt{e^{\sqrt{2x}}}$ with respect to $e^{\sqrt{2x}}\ for\ x > 0$.

OR

(b) If $(x)^y = (y)^x$, then find $\frac{dy}{dx}$.

23. Determine the values of x for which f(x) = $\frac{x-4}{x+1}, x \neq -1$ is an increasing or a decreasing function.

24. (a) If $\vec{a}$ and $\vec{b}$ are position vectors of point A and point B respectively, find the position vector of point C on BA produced such that BC = 3BA.

OR

(b) Vector $\vec{r}$ is inclined at equal angles to the three axes x, y and z. If magnitude of $\vec{r}$ is $5\sqrt{3}$ units, then find $\vec{r}$.

25. Determine the intersection point if the lines $\vec{r} = (\hat{\imath} + \hat{\jmath} - \hat{k}) + \lambda(3\hat{\imath} - \hat{\jmath})$ *and* $\vec{r} = (4\hat{\imath} - \hat{k}) + \mu(2\hat{\imath} + 3\hat{k})$ intersect with each other.

SECTION-C

This section comprises 6 Short Answer (SA) type questions of 3 marks each.

26. Let A = $\begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$ and C = $\begin{bmatrix} 3 & 4 & 2 \\ 12 & 16 & 8 \\ -6 & -8 & -4 \end{bmatrix}$ be two matrices. Then, find the matrix B, if AB = C.

27. $If\ y = 2\cos(\log x) + 3\sin(\log x), then\ prove$
$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0.$

28. (a) A student wants to pair up natural numbers in such a way that they satisfy the equation 2x + y = 41; x, y ∈ ℕ. Find the domain and range of the relation. Check if the relation thus formed is reflexive, symmetric and transitive. Hence, state whether it is an equivalence relation or not.

OR

(b) Show that the function f: ℕ → ℕ where ℕ is a set of natural numbers, given by

f(n)= $\begin{cases} n-1, & if\ n\ is\ even \\ n+1, & if\ n\ is\ odd \end{cases}$ is a bijection.

29. Consider the Linear Programming Problem, where the objective function Maximize $Z = x + 2y$

Subject to the constraints:

$x + 2y \geq 100,\ 2x - y \leq 0,\ 2x + y \leq 200,$

$x, y \geq 0$ *Solve the above LPP graphically.*

Draw a neat graph of the feasible region and find the maximum value of Z.

30. (a) Find the distance of the point P(2, 4, - 1) from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$.

OR

(b) Let the position vectors of the points A, B and C be $3\hat{\imath} - \hat{\jmath} - 2\hat{k}$, $\hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\hat{\imath} + 5\hat{\jmath} + 3\hat{k}$ respectively. Find the vector and Cartesian equations of the line passing through A and parallel to line BC.

31. A person is Head of two independent selection committees I and II. If the probability of making a wrong selection in committee I is 0.03 and that in committee II is 0.01, then find the probability that the person makes the correct decision of selection:

(i) In both committees.

(ii) In only one committee

SECTION-D

This section comprises 4 Long Answer (LA) type questions of 5 marks each.

32. (a) Find $\int \frac{x^2+1}{(x-1)^2\,(x+3)}\,dx$.

OR

(b) Evaluate: $\int_0^{\frac{\pi}{4}} \log(1+tanx)dx$

33. Draw a rough sketch for the curve y = $|x+1|$+2

Using integration, find the area of the region bounded by the curve y = | x + 1 | +2 , x = - 4, x = 3 and y = 0.

34. (a) Solve the differential equation

$x^2y\,dx - (x^3 + y^3)dy = 0.$

OR

(b) Solve the differential equation

(1 + x^2)$\frac{dy}{dx}$ + 2xy - 4x^2 = 0 subject to the initial condition y(0) = 0.

35. Let the polished side of the mirror be along the line $\frac{x}{1} = \frac{1-y}{-2} = \frac{2z-4}{6}$. A point P(1, 6, 3) some distance away from the mirror, has its image formed behind the mirror. Find the coordinates of the image point and the distance between the point P and its image.

SECTION-E

This section comprises 3 case study based questions of 4 marks each.

CASE STUDY-1

36. Three students, Neha, Rani and Sam go to a market to purchase stationary items. Neha buys 4 pens, 3 notepads and 2 erasers and pays Rs 60. Rani buys 2 pens, 4 notepads and 6 erasers for Rs 90. Sam pays Rs 70 for 6 pens, 2 notepads and 3 erasers.

Based upon the above information, answer

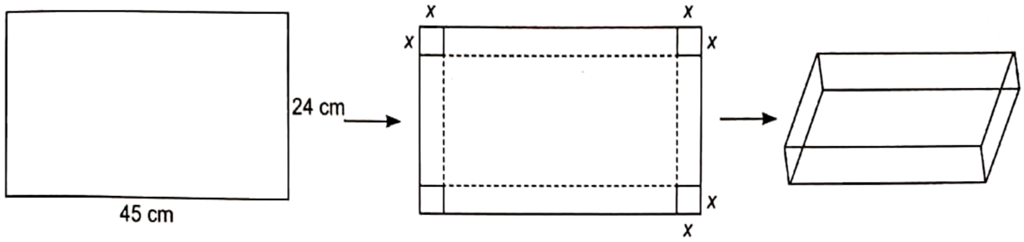
(i) Form the equations required to solve the problem of finding the price of each item, and express it in the matrix from AX = B also find A^{-1} (2)

(ii) Find the price of each item. (2)

CASE STUDY-2

37. Read the following Passage and answer -

Three friends A, B and C are given a rectangular sheet of a sides 45 cm and 24 cm. They are asked to work independently and form and open box by cutting the squares of equal length from all the four corners as shown and folding up the flaps, they want to check the volume of boxes so formed.



(i)Find the volume of the box in term of x. (2)

(ii)Find the value of x for which volume is maximum. (2)

Case Study - 3

38. A shop selling electronic items sells smart phones of only three reputed companies A, B and C because chances of their manufacturing a defective smart phone are only 5%, 4% and 2% respectively. In his inventory he has 25% smart phones from company A, 35% smart phones from company B and 40% smart phones from company C. A person buys a smart phone from this shop.

Based on the above information, answer the following questions:

(i) Find the probability that it was defective. (2)

(ii) What is the probability that this defective smart phone was manufactured by company B? (2)