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# KENDRIYA VIDYALAYA SANGTHAN TINSUKIA REGION

## PRE BOARD EXAMINATION 2024-25

## CLASS: XII

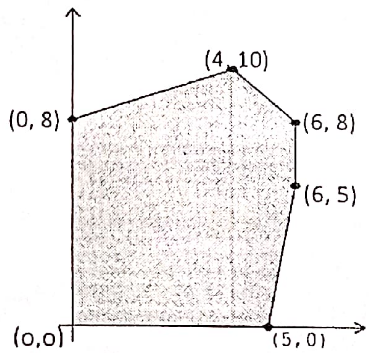
## SUBJECT: -MATHEMATICS (041) SET 02

Time: - 3 Hours | Max 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 (4 marks each) with sub parts.

| Q | SECTION – A (MCQs 1 mark each) | Marks |
|---|---|---|
| 1 | The number of all possible matrices of order $3 \times 3$ with each entry 0 or 1 is:<br>(a) 27 (b) 18 (c) 81 (d) 512 | 1 |
| 2 | If $A = [a_{ij}]$ is a symmetric matrix of order n, then<br>(a) $a_{ij} = \frac{1}{a_{ij}}$ for all i,j (b) $a_{ij} \neq 0$ for all i,j<br>(c) $a_{ij} = a_{ji}$ for all i,j (d) $a_{ij} = 0$ for all i, j | 1 |
| 3 | Let A be a non-singular square matrix of order $3 \times 3$ and $\|adj\ A\| = 8$ then $\|A\|$ is equal to<br>(a) $\pm 64$ (b) $\pm 16$ (c) $\pm 8$ (d) none of the these | 1 |
| 4 | The area of a triangle with vertices $(-3, 0)$, $(3, 0)$ and $(0, k)$ is 9 sq. units. The value of $k$ will be<br>(a) 3 (b) $\pm 3$ (c) $-3$ (d) 6 | 1 |
| 5 | If A and B are invertible matrices, then which of the following is not correct?<br>(a) $adj\ A = \|A\|. A^{-1}$ (b) $\det(A)^{-1} = [\det(A)]^{-1}$<br>(c) $(AB)^{-1} = B^{-1} A^{-1}$ (d) $(A + B)^{-1} = B^{-1} + A^{-1}$ | 1 |
| 6 | The function $f(x) = [x]$, where $[x]$ denotes the greatest integer function, is continuous at<br>(a) 4 (b) $-2$ (c) 1 (d) 1.5 | 1 |
| 7 | Differential coefficient of $\sec(\tan^{-1}x)$ w.r.t. $x$ is<br>(a) $\frac{x}{\sqrt{1+x^2}}$ (b) $\frac{x}{1+x^2}$ (c) $x\sqrt{1+x^2}$ (d) $\frac{1}{\sqrt{1+x^2}}$ | 1 |
| 8 | The rate of change of the area of a circle with respect to its radius $r$ at $r = 6$ cm is<br>(a) $10\pi$ (b) $12\pi$ (c) $8\pi$ (d) $11\pi$ | 1 |
| 9 | On which of the following intervals is the function $f$ given by $f(x) = x^{100} + \sin x - 1$ decreasing?<br>(a) (0.1) (b) $(\frac{\pi}{2}, \pi)$ (c) $(0, \frac{\pi}{2})$ (d) None of these | 1 |
| 10 | $\int \frac{dx}{\sin^2 x \cos^2 x}$ *is equal to*<br>(a) $\tan x + \cot x + c$ (b) $\sin x + \cos x + c$<br>(c) $\tan x - \cot x + c$ (d) $\sin x - \cos x + c$ | 1 |

| | | |
|---|---|---|
| 11 | The value of $\int_a^{-a} \sin^3 x \, dx$ is<br>(a) a (b) a/3 (c) 1 (d) 0 | 1 |
| 12 | The degree of the differential equation<br>$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0 \ is$<br>(a) 3 (b) 2 (c) 1 (d) not defined | 1 |
| 13 | A homogeneous differential equation of the from $\frac{dy}{dx} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution.<br>(a) $y = vx$ (b) $v = yx$ (c) $x = vy$ (d) $x = v$ | 1 |
| 14 | If $\vec{a}$ is nonzero vector of magnitude '$a$' and $\lambda$ is a nonzero scalar, then $\lambda\vec{a}$ is unit vector if<br>(a) $\lambda = 1$ (b) $\lambda = -1$ (c) $a = \vert \lambda \vert$ (d) $a = \frac{1}{\vert\lambda\vert}$ | 1 |
| 15 | The coordinates of the foot of the perpendicular drawn from the point (2, 5, 7) on the $x$-axis are given by<br>(a) (2, 0, 0) (b) (5, 0, 0) (c) (7, 0, 0) (d) (0, 5, 7) | 1 |
| 16 | The feasible solution for a LPP is shown in given figure. Let Z = 3x-4y be the objective function. Minimum of Z occurs at<br>a) (0,0)<br>b) (0,8)<br>c) (5,0)<br>d) (4,10)<br><br> | 1 |
| 17 | Inequation $y - x \leq 0$ represents<br>(a) The half plane that contains the positive X-axis<br>(b) Closed half plane above the line y = x, which contains positive Y-axis<br>(c) Half plane that contains the negative X-axis<br>(d) None of these | 1 |
| 18 | If A and B are two events such that P(A) + P(B) - P(A and B) = P(A), then<br>(a) P(B/A) =1 (b) P(A/B) =1 (c) P(A/B) =0 (d) P(B/A) =0 | 1 |

**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 | A: The Principal value of $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) + 2\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is equal to $\frac{5\pi}{4}$<br>R: Domain of $\cos^{-1} x$ and $\sin^{-1} x$ are respectively $(0, \pi)$ and $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ | 1 |

| | | |
|---|---|---|
| 20 | A: The following straight lines $L_1$ & $L_2$ are perpendicular to each other. $$\frac{x+1}{2}=\frac{y-2}{5}=\frac{z+3}{4} \text{ and } \frac{1-x}{-1}=\frac{y+2}{2}=\frac{3-z}{3}$$ R: Let line $L_1$ passes through the point $(x_1, y_1, z_1,)$ and parallel to the vector whose direction ratios are $a_1, b_1$, and $c_1$, and let line $L_2$ passes through the point $(x_2, y_2, z_2,)$ and parallel to the vector whose direction ratios are $a_2, b_2$, and $c_2$, · Then the lines $L_1$ & $L_2$ are perpendicular if $a_1.a_2 + b_1.b_2 + c_1.c_2 = 0$ | 1 |

**SECTION – B**

This section comprises of very short answer type-questions (VSA) of 2 marks each.

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|---|---|---|
| 21 | Check whether the relation R in the set R of real numbers, defined as R = $\{(a, b) : a \leq b^2\}$ is transitive. not transitive. | 2 |
| 22 | Find $\frac{dy}{dx}$ of the function $y^x = x^y$ <br> *OR* <br> Find the values of $k$ so that the function $f$ is continuous at the indicated point $f(x) = \begin{cases} kx+1, & if\ x \leq \pi \\ \cos x, & if\ x > \pi \end{cases}$ at $x = \pi$ | 2 |
| 23 | Evaluate $\int \left[\frac{(x+1)(x+\log x)^2}{x}\right] dx$ | 2 |
| 24 | Using integration find the area of the region in the first quadrant enclosed by the circle $x^2 + y^2 = 16$ . <br> OR <br> Using integration find the area of the region in the first quadrant enclosed by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ . | 2 |
| 25 | If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ , find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$ . | 2 |

**SECTION C**

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

| | | |
|---|---|---|
| 26 | If $y = 3\cos(\log x) + 4\sin(\log x)$, show that $x^2y_2 + xy_1 + y = 0$ | 3 |
| 27 | Evaluate: $\int \sqrt{1+3x-x^2}\, dx$ <br> OR <br> Evaluate: $\int_0^1 (xe^x + \sin\frac{\pi x}{4})\, dx$ | 3 |
| 28 | The area between $x = y^2$ and $x = 4$ is divided into two equal parts by the line $x = a$, find the value of $a$. | 3 |
| 29 | Solve the differential equation $\frac{dy}{dx} = \frac{x+y}{x}$ <br> OR <br> Solve the differential equation $x\frac{dy}{dx} + 2y = x^2$ ; $(x \neq 0)$ | 3 |
| 30 | Solve the following Linear Programming Problem graphically: | 3 |

Maximize $Z = 5x + 2y$,

subject to the constraints:

$x - 2y \leq 2$,

$3x + 2y \leq 12$,

$-3x + 2y \leq 3$,

$x \geq 0, \; y \geq 0$.

**31** An urn contains 10 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black? **3**

OR

The random variable X has a probability distribution P(X) of the following form, where $k$ is some number:

$$P(X)=\begin{cases} k, & if\ x = 0 \\ 2k, & if\ x = 1 \\ 3k, & if\ x = 2 \\ 0, & otherwise \end{cases}$$

(a) Determine the value of $k$. 1/6

(b) Find P (X < 2), 1/2

(c) Find P (X≥2), 1/2

## SECTION D

**(This section comprises of long answer-type questions (LA) of 5 marks each)**

**32** Show that the function f: R→R defined by $f(x) = \frac{x}{x^2+1}$, $\forall x \in R$ is neither one-one nor onto. **5**

**OR**

If N denotes the set of all natural numbers and R be the relation on N × N defined by (a, b) R (c, d), if ad(b + c) = bc(a + d). Show that R is an equivalence relation.

**33** Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it to solve the system of equations **5**

$$x - y + z = 4,$$
$$x - 2y - 2z = 9$$
$$2x + y + 3z = 1.$$

**34** Evaluate $\int \frac{1}{\cos(x-a)\cos(x-b)} dx$ **5**

OR

Evaluate $\int_0^{\frac{\pi}{2}} \log \sin x \; dx$.

**35** Find the shortest distance between $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$ $2\sqrt{29}$ **5**

OR

Find the vector equation & cartesian equations of the line which is perpendicular to the lines with equations

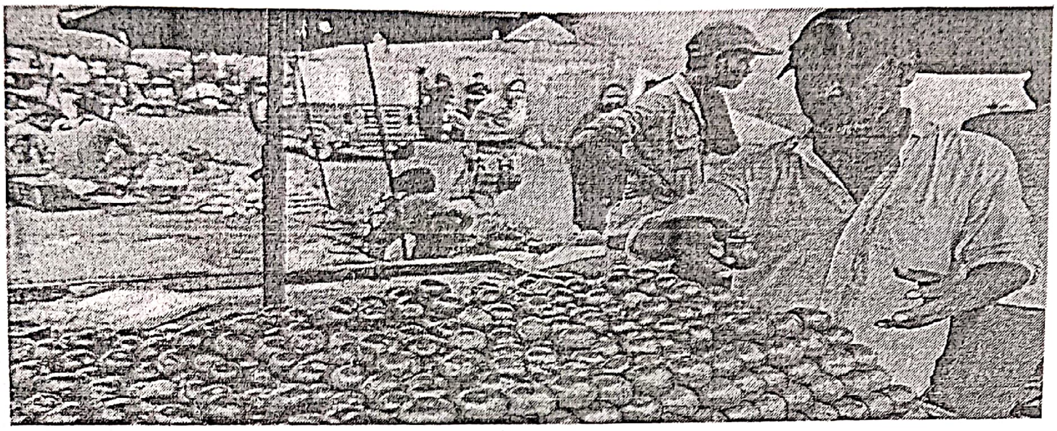
$$\frac{x+2}{1} = \frac{y-3}{2} = \frac{z+1}{4} \; and \; \frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$$

and passes through the point (1,1,1). Also find the angle between the given lines.

## SECTION E

**(This section comprises of with two sub-parts. First two case study questions have three subparts of marks 1, 1, 2 respectively. The third case study question has two sub parts of 2 marks each.)**

36 The Government declare that farmers can get Rs 300 per quintal for their Tomatoes on 1st July and after that, the price will be dropped by Rs 3 per quintal per extra day. Raman's father has 80 quintal of Tomatoes in the field on 1st July and he estimates that crop is increasing at the rate of 1 quintal per day.



Based on the above information, answer the following questions.

(i) If x is the number of days after 1st July, then write price and quantity of Tomato in terms of x. $(300-3x)$ $(80+x)$ 1

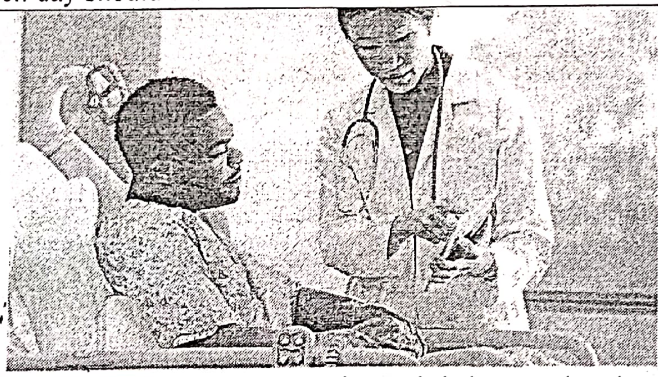
(ii) Find the Revenue in terms of x. $-3x^2+60x+24000$ 1

(iii) Find the number of days after 1st July, when Raman's father attains maximum revenue. 10 2

OR

On which day should Raman's father harvest the tomatoes to maximise his revenue? 11th July

37

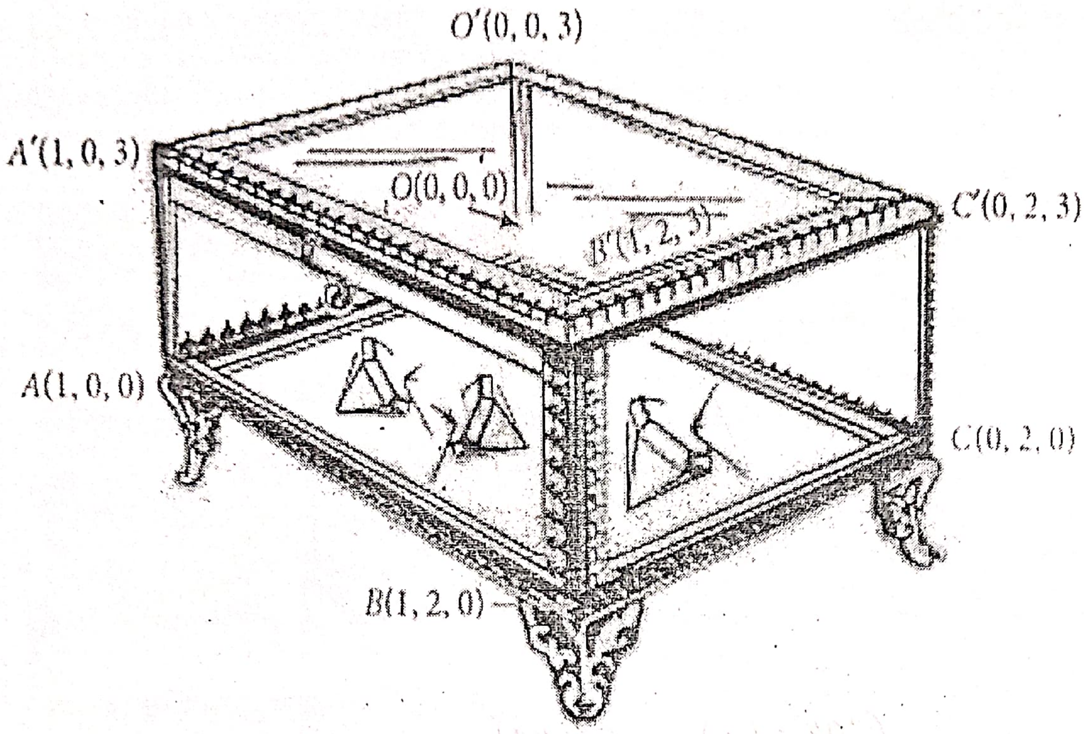


A doctor is to visit a patient. From the past experience, it is known that the probabilities that she will come by train, bus, scooter or by other means of transport are respectively 3/10, 1/5, 1/10 and 2/5. The probabilities that she will be late are 1/4, 1/3, and 1/12, if she comes by train, bus and scooter respectively, but if she comes by other means of transport, then she will not be late.

(i) Find the total probability that she arrives late. $3/20$ 2

(ii) One day, when she arrives, she is late. What is the probability that she comes by train? 2

$1/2$

| | | |
|---|---|---|
| 38 | In a diamond exhibition, a diamond is covered in cubical glass box having coordinates $O(0, 0, 0)$, $A(1, 0, 0)$, $B(1, 2, 0)$, $C(0, 2, 0)$, $O'(0, 0, 3)$, $A'(1, 0, 3)$, $B'(1, 2, 3)$ and $C'(0, 2, 3)$.<br><br><br>Based on the above information, answer the following questions.<br>(i)Find the Direction ratios of $OA$ $1, 0, 0$<br>(ii) find the Equation of diagonal $OB'$ $\rightarrow \frac{x}{1} = \frac{y}{2} = \frac{z}{3}$<br>(iiI) find the Equation of Line $O'B'$ $\rightarrow \frac{x}{1} = \frac{y}{2} = \frac{z-3}{0}$<br>OR<br>Find the cartesian equation of line along $\overrightarrow{A'C'}$ $\rightarrow \frac{x-1}{1} = \frac{y}{-2} = \frac{z-3}{0}$ | 1<br>1<br>2 |