CENTRE FOR ADVANCEMENT OF STANDARDS IN EXAMINATIONS
(GEMS ASIAN SCHOOLS)
COMMON REHEARSAL EXAMINATIONS 2025- 2026

(ALL INDIA SENIOR SCHOOL CERTIFICATE EXAMINATION)

Subject: Mathematics | **Time: 3 Hours**
Subject Code: 041 | **Max. Marks: 80**

General Instructions

Read the following instructions very carefully and strictly follow them:

(i) This Question paper contains 38 questions. All questions are compulsory.
(ii) This Question paper is divided into five Sections - A, B, C, D and E.
(iii) In Section A, Questions no. 1 to 18 are multiple-choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
(iv) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
(v) In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
(vi) In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
(vii) In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
(viii) 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 one subpart each in 2 questions of Section E.
(ix) Use of calculators is not allowed.

SECTION A

(This section comprises of multiple-choice questions (MCQs) of 1 mark each)
Select the correct option (Question 1 - Question 18):

Q1. Matrix A has m rows and n+5 columns; matrix B has m rows and 11 - n columns. If both AB and BA exist, then — 1

m×(n+5) m×(11−n)

a)AB and BA are symmetric matrices b)AB and BA are square matrices
c)AB and BA are skew symmetric matrices d)None of these.

Q2 If $\vec{p} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{q} = -\hat{i} + 2\hat{j} + 2\hat{k}$,then which of the following is correct? — 1

4+9+1 1+4+4

a) $\vec{p}$ is parallel to $\vec{q}$ b) $\vec{p}$ is perpendicular to $\vec{q}$ c) $|\vec{p}| > |\vec{q}|$ d) $|\vec{p}| = |\vec{q}|$

Q3 $\int_{-3}^{3} \frac{|x-1|}{x-1} dx$, $x \neq 1$ is equal to — 1

a) 0 b) -2 c) 4 d) 2

Q4 Which of the following is a homogeneous differential equation?

a) $(4x+6y+5)\,dy - (3y+2x+4)\,dx = 0$ b) $(xy)\,dx - (x^3 + y^3)\,dy = 0$

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

Q5 The function $f(x) = \frac{16-x^2}{16x-x^3}$ is

a) Discontinuous at only one point b) Discontinuous at exactly two points

c) Discontinuous at exactly three points d) None of these

Q6 If A is a nonsingular matrix of order 3 such that $A^2 = 3A$, then the value of $|A|$ is

a) -3 b) 3 c) 9 d) 27

Q7 If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$, $P(A \cap B) = \frac{4}{13}$, then $P(A' | B)$ is

a) $\frac{6}{13}$ b) $\frac{4}{13}$ c) $\frac{4}{9}$ d) $\frac{5}{9}$

Q8 The intervals in which the function $f(x) = x^2 e^{-x}$ is strictly increasing on

a) $(-\infty, \infty)$ b) $(-\infty, 0)$ c) $(2, \infty)$ d) $(0,2)$

Q9 Number of symmetric matrices of order 3X3 with each entry 1 or -1 is 1

a) 512 b) 64 c) 8 d) 4

Q10 $\int_0^{\frac{\pi}{2}} \frac{\sin x - \cos x}{1 + \sin x \cos x}\,dx$ is equal to 1

a) π b) 0 c) $\int_0^{\frac{\pi}{2}} \frac{2\sin x}{1+\sin x \cos x}\,dx$ d) $\frac{\pi^2}{4}$

Q11 Let θ be the angle between two-unit vectors $\hat{a}$ and $\hat{b}$, such that $\sin\theta = \frac{3}{5}$. Then $\hat{a}.\hat{b}$ 1

a) $\pm\frac{3}{5}$ b) $\pm\frac{3}{4}$ c) $\pm\frac{4}{5}$ d) $\pm\frac{4}{3}$

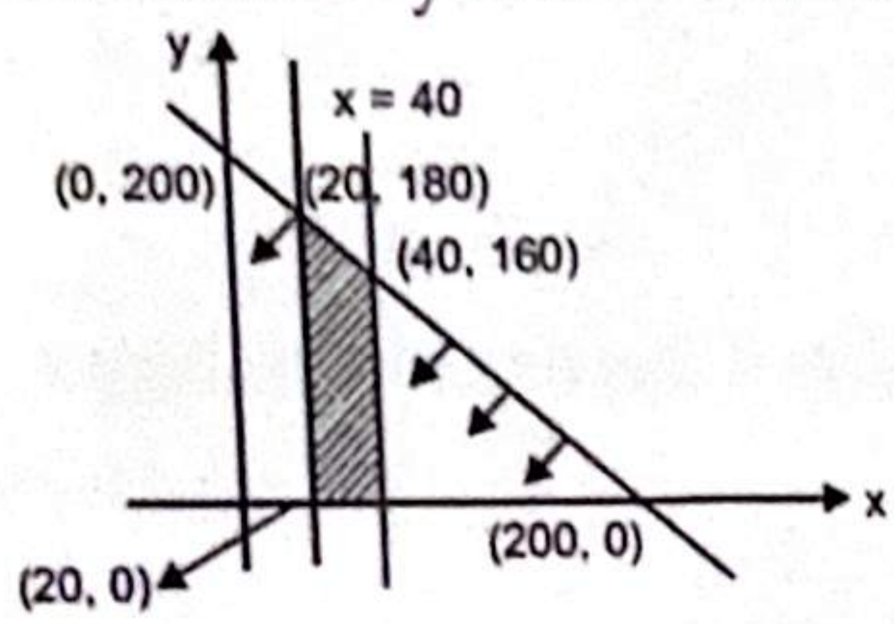
Q12 The number of arbitrary constants in the particular solution of a differential equation of order 3 is 1

a) 3 b) 4 c) infinite d) 0

Q13 If $A = \begin{bmatrix} 6 & 0 & x \\ 0 & 6 & 0 \\ 0 & 0 & y \end{bmatrix}$ is a scalar matrix, then y^x is equal to 1

a) 0 b) 1 c) 6 d) ± 6

Q14 For an L.P.P. the objective function is $Z = 400x + 300y$, and the feasible region determined by a set of constraints (linear inequations) is shown in the graph. 1



Coordinates at which the objective function is maximum is

a) (20,0) b) (40,0) c) (40,160) d) (20,180)

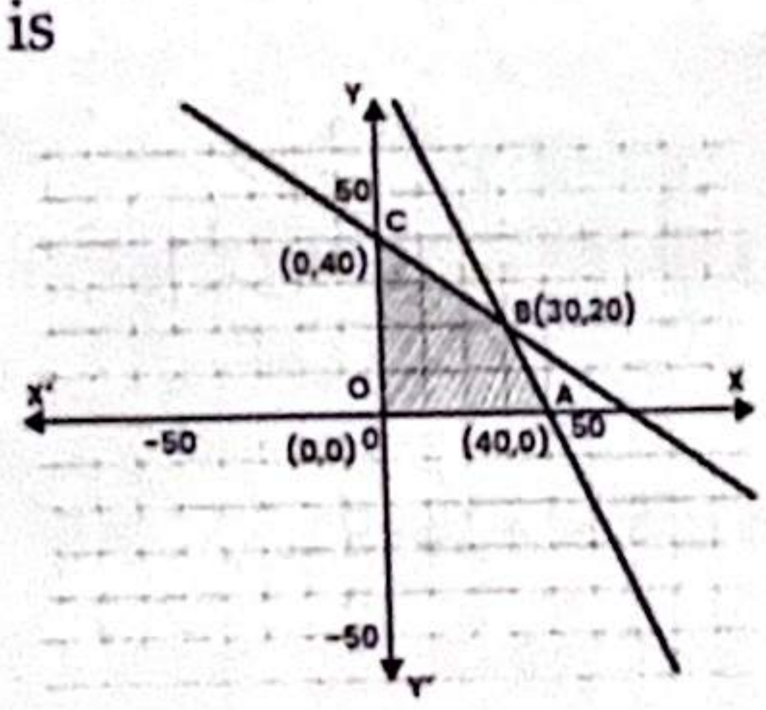
Q15 The area of the region bounded by the curve $y^2 = x$, $x = 4$ and the x axis is 1

a) $\frac{8}{3}$ sq. units b) 16 sq. units c) 32 sq. units d) $\frac{16}{3}$ sq. units

Q16 Let $A = \begin{bmatrix} 2 & 6 & 3 \\ 4 & 5 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 \\ 2 & 4 \\ 1 & 6 \end{bmatrix}$ Which of the following option is true regarding the above matrices? 1

a) Only AB is defined
b) Only BA is defined
c) Both AB and BA are defined
d) Both AB and BA are not defined.

Q17 The corner points of the bounded feasible region of an LPP are O(0,0), A(40,0), B(30,20) and C(0,40). If the maximum value of the objective function Z= 2ax+by occurs at the point B(30,20) and C(0,40), then the relation between a and b is 1



a) 2a =b b) a=2b c) 3a=b d) a =3b

Q18 The domain of $\cos x + \sin^{-1} x$ is : 1

a) (-1, 1) b) R c) [-1, 1] d) ∅

ASSERTION-REASON BASED QUESTIONS

(Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (a), (b), (c) and (d) as given below.)

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)** :Let f : R→ R given by 1

$$f(x) : \frac{|x|}{x} = \begin{cases} 1 \; if \; x > 0 \\ 0 \; if \; x = 0 \\ -1 \; if \; x < 0 \end{cases}$$ is a bijection.

Reason (R) : A function g : A → B is said to be a bijection if it is one one and onto .

Q20 **Assertion (A)** : If $f(x) = \sin^{-1}x + \cos^{-1}x + 2$ then $f'(1) = 0$ 1

Reason (R): $\frac{d}{dx}(\sin x) = \cos x$

SECTION B

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

Q21 Differentiate 3^{sin^2x} with respect to sin^2x . 2

OR

If $x^y = e^{x+y}$ prove that $\frac{dy}{dx} = \frac{logx-2}{(logx-1)^2}$

Q22 Evaluate $sin^{-1}[\cos(sin^{-1}(\frac{\sqrt{3}}{2}))]$ 2

Q23 Find the area of the parallelogram ABCD whose side AB and the diagonal AC are given by the vectors $3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ *and* $4\hat{\imath} + 5\hat{k}$ respectively. 2

Q24 Find the absolute maximum and absolute minimum value of the function $f(x) = \frac{1}{x+4}$ on the interval [0 ,1] 2

Q25 If the projection of the vector $\hat{\imath} + \hat{\jmath} + \hat{k}$ on the vector $p\hat{\imath} + \hat{\jmath} - 2\hat{k}$ *is* $\frac{1}{3}$ then find the value of p. 2

OR

Two children are flying kites from different rooftops, and their kite strings appear to intersect in the sky. The directions of the kite strings can be represented by the vectors $\vec{p} = 2\hat{\imath} + \hat{\jmath} + 2\hat{k}$ *and* $\vec{q} = \hat{\imath} - 3\hat{\jmath} + 6\hat{k}$. Find the angle formed between the kite strings. Assume the strings are taut (no slack).

SECTION C

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

Q26 For the curve $y = 5x - 2x^3$ if x increases at the rate of 2 units/sec, then how fast is the slope of the curve changing when x = 3. 3

Q27 Solve the linear programming problem graphically. 3

Maximise and minimize Z= 5x+10y , subject to the constraints:

$x+2y \leq 120$

$x+y \geq 60$

$x-2y \geq 0$

$x, y \geq 0$

Q28 Evaluate: $\int \frac{dx}{1+3e^x+2e^{2x}}$ 3

OR

Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x+\cos x}$ dx

Q29 Verify that the lines given by $\hat{r}$ =(2+t) $\hat{\imath}$ -(3t-1)$\hat{\jmath}$ +(4-t) $\hat{k}$ and $\hat{r}$ =(1+2s)$\hat{\imath}$ +(5 -s)$\hat{\jmath}$ +(s+1)$\hat{k}$ are skew lines. Hence, find the shortest distance between the lines. 3

OR

During a treasure hunt,the positions of the starting point,the checkpoint,and the final treasure spot are collinear and given by $\vec{S}=4\hat{\imath}+3\hat{\jmath}$, $\vec{C}=10\hat{\imath}+9\hat{\jmath}$, $\vec{T}=16\hat{\imath}+15\hat{\jmath}$ respectively. Calculate the ratio in which the checkpoint divides the line segment joining the starting point and the final treasure spot.

Q30 Three critics review a book. For the three critics, the odds in favour of the book are 5:2, 4:3 and 3:4 respectively. Find the probability that the majority is in favour of the book. 3

OR

Three events A,B and C have probabilities $\frac{2}{5}, \frac{1}{3}$ and $\frac{1}{2}$ respectively. Given that $P(A \cap C) = \frac{1}{5}$ and $P(B \cap C) = \frac{1}{4}$, then find (i) $P(C|B)$ (ii) $P(A' \cap C')$ (iii) $P(A'|C')$

Q31 Find the area of the region bounded by the curve $4x^2 + y^2 = 36$ using integration. 3

SECTION D

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

Q32 If $\sqrt{4-x^2} + \sqrt{4-y^2}$ = a(x-y) ,Prove that $\frac{dy}{dx} = \frac{\sqrt{4-y^2}}{\sqrt{4-x^2}}$ 5

Q33 Show that the differential equation $(x^3-3xy^2)dx = (y^3-3x^2y)dy$ is homogeneous and solve it. 5

OR

Find the particular solution of the differential equation $(1-x^2)\frac{dy}{dx} - xy = x^2$, given that y=2 and x=0.

Q34 A drone is flying in 3D space and is currently at point A(1,6,3) . A laser beam is directed along the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$. The drone reflects off the laser beam such that its path is symmetric with respect to the beam's line. 5

i)Find the coordinates of image A^{l} of the drone after reflection.

ii)Write the equation of the straight line that represents the path connecting A and A^{l}.

OR

Anuj and Arun are flying kites from their rooftops. Anuj's kite's string is represented by the straight line given by $\frac{x-4}{1}=\frac{y-2}{3}=\frac{z-1}{2}$ .Arun's position is at $(2\hat{\imath}-2\hat{\jmath}+\hat{k})$, and his kite's string is perpendicular to Anuj's string. Find the distance between Arun and the point of intersection of the two strings.

Q35 A company is distributing its annual bonus among three departments: Sales, Marketing, and Development based on the following rules: 5

- The bonus amount for the sales department must be equal to the combined bonus amounts for the marketing and development departments.
- The Marketing department's bonus is Rs.15,000, more than half the bonus of the sales department.
- The total bonus amount to be distributed among all three departments is Rs.200,000.

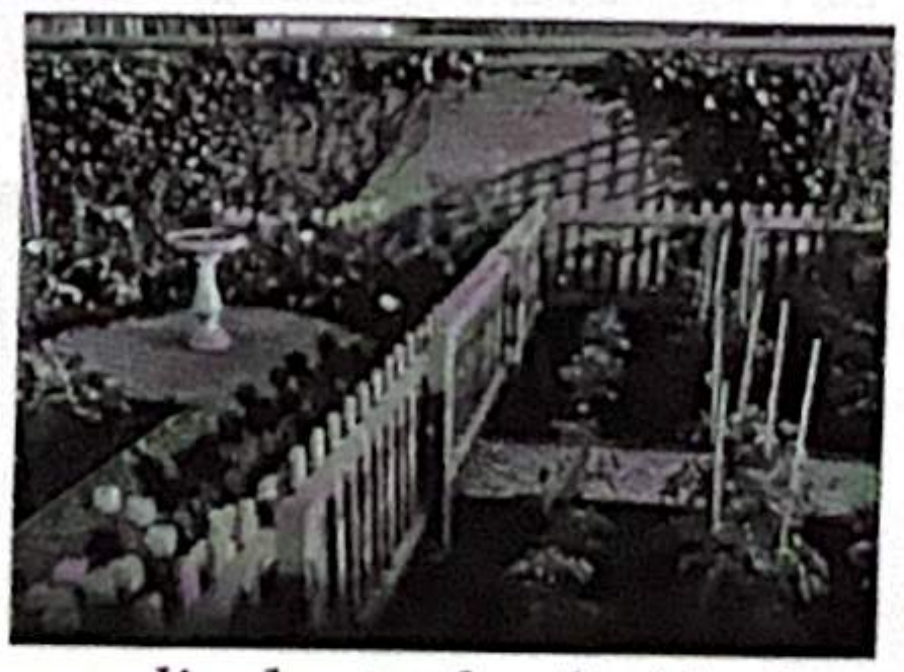
Find the bonus amount allocated to each department, using the matrix method.

SECTION E

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

Q36 Case Study-1:

A landscaper wants to fence a rectangular garden using 400 m of fencing material. The design includes a divider fence running parallel to one of the sides, splitting the garden into two equal sections.



Let the length of the side perpendicular to the divider be x meters and the length of the side parallel to the divider be y meters. Based on this information, answer the following questions:

(i) Write the equation for the total fencing material used for the boundary and the divider in terms of x and y. 1

(ii) Write the area of the garden as a function of x. 1

(iii) (a) Find the critical points of the area function. Use the second derivative test to determine the critical points at the maximum area. Also, find the maximum area.

OR 2

(iii) (b) Using the first derivative test, calculate the maximum area the landscaper can enclose with the 400 meters of fencing, considering the parallel divider.

Q37 **Case Study-2:**

Let C be the set of 45 students of class 11 in a school.

Let $g : C \rightarrow N$, N is the set of natural numbers such that function f(x) = Identity number of student x. Based on the given information, answer the following questions.

(i) Is f an injective function? Justify your answer. 1

(ii) Is f a bijective function? Justify your answer. 1

(iii) (a) Let R be a relation defined by the teacher to plan the seating arrangement of students in pairs, where R= {(x, y) : x and y are the roll numbers of students such that y = 2x}.List the elements of R.Is the relation is reflexive, symmetric, transitive? 2

OR

(iii) (b) Consider the function f: $N \rightarrow N$ defined by f(x) = 2x . Is f a bijective function ?.Justify your answer.

Q38 **Case Study-3:**

A tech company produces three types of laptops: Standard, Gaming, and Ultrabook. Past data indicates that a customer buys a Standard laptop with a probability of 40%, a Gaming laptop with a probability of 30%, and an Ultrabook with a probability of 30%.The company's records also show that the probability of a laptop being returned due to a manufacturing defect is 2% for Standard laptops, 5% for Gaming laptops, and 1% for Ultrabook's.

Based on this information, answer the following questions:

(i) What is the probability that a random laptop sold by the company will be returned due to a manufacturing defect? 2

(ii) A customer returns a laptop due to a manufacturing defect. What is the probability that the laptop was a Gaming laptop? 2

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