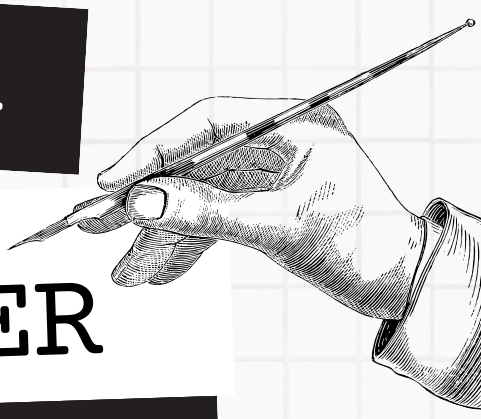
2024

Pre-Board



SAMPLE PAPER

CBSE BOARD / STATE BOARDS

NCERT Based Syllabus



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PRACTICE PAPER FOR PRE BOARD EXAMINATION
CLASS XII
Session 2023-24
MATHEMATICS (041)

Time Allowed: 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 MCQs and 02 Assertion -Reason based questions** of 1 mark each.
3. **Section B has 8 Response based MCQ's of 2 marks each.**
4. **Section C** has **4 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.

SECTION A α
(Multiple Choice Questions)
Each question carries 1 mark

Q1. If $A = \begin{bmatrix} 4 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, and if A^{-1} exists, then

(a) $\lambda = 2$ (b) $\lambda \neq 2$ (c) $\lambda = -2$ (d) $\lambda \neq -2$

Q2. If $A = [a_{ij}]$ is a 2×3 matrix, such that $a_{ij} = \frac{(-i+2j)^2}{5}$. then a_{23} is

(a)) $\frac{1}{5}$ (b)) $\frac{2}{5}$ (c) $\frac{9}{5}$ (d)) $\frac{16}{5}$

Q3. If A is a square matrix of order 3 and $|A| = 5$, then $|A\ adjA|$ =

(a) 125 (b)25 (c) 625 (d)5

Q4. If for any square matrix A, $A(adjA) = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$ then value of $|A|$

(a) 3 (b)6 (c) 8 (d) 1

Q5. If $\begin{vmatrix} 3x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 9 & 5 \\ 8 & 3 \end{vmatrix}$, then find x.

(a) 3 (b)6 (c) ±3 (d) 1

Q6. If the function $f(x) = |x+1| + |x+2|$ is not differentiable at p and q then the value of $p + q$ is

(a) 3 (b)–3 (c) ±3 (d) 0

Q7. The value of k which makes the function $(x) = \begin{cases} x\sin\frac{1}{x}, \text{if } x \neq 0 \\ k-1, \text{if } x = 0 \end{cases}$, is continuous at x = 0

(a) 1 (b)0 (c) ±1 (d) –1

Q8. If $\int \frac{\sin x}{\sin(x-a)} dx = Ax + B\log|\sin(x-a)| + C$ then the value of $A^2 + B^2$ is

(a) 2x (b)0 (c) 1 (d) π

Q9. The direction cosine of a line equally inclined to the axes is?

(a) 1,1,1 (b)±1, ±1,±1 (c) $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$ (d) 1, 0, 0

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Q10. Let A and B be two events. If P (A) = 0.2, P (b)= 0.4, P (A∪B) = 0.6, then P (A|B) is equal to
(a) 0.5 (b) 0.8 (c) 0.3 (d) 0

Q11. If m is the order and n is the degree of given differential equation,
$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^5 + x^4 = 0$ then what is the value of m + n
(a) 5 (b)9 (c) 4 (d) 7

Q12.If $\vec{a}$ and $\vec{b}$ be two-unit vectors and θ is the angle between them. Then $\vec{a} + \vec{b}$ is a unit vector, if θ =
(a) $\frac{\pi}{4}$ (b)$\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{2\pi}{3}$

Q13. If magnitude of vector $x(\hat{i} + \hat{j} + \hat{k})$ is '**3 units**' then the value of x is
(a) $\frac{1}{3}$ (b)) $\sqrt{3}$ (c) $\pm \frac{1}{\sqrt{3}}$ (d)) $\pm \sqrt{3}$

Q14. The projection of $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ along $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$ is
(a) $\frac{2}{3}$ (b)– $\frac{2}{3}$ (c) 2 (d) $\sqrt{6}$

Q15. The direction ratio of the line $\frac{3-2x}{4} = \frac{y+5}{3} = \frac{6-z}{6}$ is
(a) 4, 3, 6 (b)2, 3, – 6 (c) 2, –3, 6 (d) – 2, –3, –6

Q16. The objective function Z = 4 x + 3 y can be maximized subjected to the constraints
$3x + 4y \leq 24$, $4x + 3y \leq 24$, $x, y \geq 0$
(a) at only one point (b) does not exist (c) at two points only (d) at an infinite number of points

Q17.The corner points of feasible solution region determined by the system of linear constraints are (0, 10), (5, 5), (15,15), (0,20). Let $Z = px + qy$, where p, q> 0.
Condition on p and q so that the maximum of Z occurs both the point (5,5) and (0,10) is
(a) p = 2q (b) p = q (c) q = 2p (d) q = 3p

Q18. A couple has 2 children. Then probability that both are boys, if it is known that one of the children is a boy is?
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d)) 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, R is false.
(d) A is false, R is true.

Q19. Assertion (A): $\sin^{-1}(-x) = -\sin^{-1} x; x \in [-1,1]$
Reason (R): $\sin^{-1}: [-1,1] \rightarrow [0, \frac{\pi}{2}]$ is a bijection function.

Q20.Assertion (A): $f(x) = \begin{cases} x^2 + 1 & , x \leq 1 \\ 2x & , x > 1 \end{cases}$ is continuous at x =1
Reason (R): LHL and RHL both are equal and it is equal to f(1).

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SECTION-B

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

Q21. If $0 < \alpha < \frac{\pi}{2}$ and $\sin\alpha = \frac{1}{2}$; Evaluate: $\tan^{-1}\{2\cos(3\pi - 2\alpha)\}$

(a) $-\pi/4$ (b) $\pi/4$ (c) $\pi/6$ (d) $-\pi/6$

OR

$f : R \to R$ defined by $f(x) = x|x|$ is

(a) One –one but not onto (b) Onto but not one one

(c) one-one and onto (d) None of these

Q22. If $x^m y^n = (x + y)^{m+n}$ then $\frac{dy}{dx}$ is

(a) $\frac{x}{y}$ (b) $\frac{1}{y}$ (c) $\frac{1}{x}$ (d) $\frac{y}{x}$

Q23. A man 1.6 m tall walks at a rate of 0.3 m/sec away from a street light that is 4m above the ground. At what rate is the tip of the shadow moving?

(a) 0.2 (b) 0.3 (c) 0.5 (d) 0.6

Q24. Evaluate $\int \frac{1}{x(x+1)}\,dx$

(a) logx-log(x+1) (b) logx (c) log (x+1) (d) xlogx

Q25. Evaluate $\int_0^{\pi/4} \log(1 + \tan x)\,dx$

(a) $\frac{\pi}{8}$ (b) $\frac{\pi}{8}\log 2$ (c) log2 (d) $-\frac{\pi}{8}\log 2$

Q26. Solve the differential equation: $y(1 + e^x)\,dy = (y + 1)\,e^x\,dx$.

(a) $y = c\frac{y+1}{1+e^x}$ (b) $x = c\frac{y+1}{1+e^x}$ (c) $y = c\frac{y}{1+e^x}$ (d) none of these

Q27. For two events A and B let $P(A) = \frac{1}{2}$ $P(AUB) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{6}$ then what is $P(\overline{A} \cap B)$ is

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

Q28. If $f(x) = x^2 - 6x + 5$ is strictly increasing on

(a) $x > 2$ (b) $x < 2$. (c) $x > 3$ (d) $x < 3$

SECTION C

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

Q29. Find $\int \frac{1}{\sin(x-a).\cos(x-b)}\,dx$

Q30. Find $\int \frac{x+3}{\sqrt{5-4x-x^2}}\,dx$

OR

Find $\int \frac{x^2}{(x^2+1)(x^2+4)}\,dx$

Q31. Solve the following linear programming problem graphically:

Minimise Z = 200x + 500y

Subject to constraints: $x + 2y \geq 10$, $3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$;

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Q32. Show that $f(x) = |x - 1|$ is not differentiable at $x = 1$

SECTION D

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

Q33. If $A = \begin{bmatrix} 2 & 3 & 1 \\ -3 & 2 & 1 \\ 5 & -4 & -2 \end{bmatrix}$, find A^{-1} and use it to solve the system of equations:

$2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$, $x + y - 2z = -3$

Q34. Consider a function $f : R_+ \rightarrow [-5, \infty)$ defined as $f(x) = 9x^2 + 6x - 5$. Show that f is one- one and onto function, Where R_+ is the set of all non-negative real numbers.

OR

Let N be the set of all natural numbers & R be the relation on N × N defined by { (a , b) R (c , d) iff a + d = b + c}. Show that R is an equivalence relation.

Q35. Using integration find the area of the region $\{(x, y) : |x| \leq y \leq \sqrt{4 - x^2}\}$.

Q36. Find the equation of the lines through origin which intersect the line $\frac{x-3}{2} = \frac{y-3}{1} = \frac{z}{1}$ at an angle of $\frac{\pi}{3}$

OR

Find equation of line which passes through (1,1,1) and intersects the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x+2}{1} = \frac{y-3}{2} = \frac{z+1}{4}$

SECTION E

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

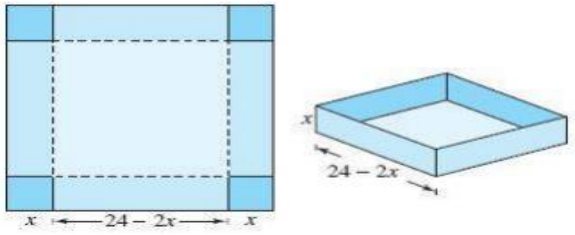
Q37. If Sunil and his friend walking through along two sides of parallelogram shaped agricultural field. Vector representation of sides of field are $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$

(i) find the both diagonals of field

(ii) find area of the field by using sides

(iii) find the area of the field by using diagonals .

Q38. Case-Study II- Aman has an expensive square shape piece of golden board of size 24 cm is to be made into a box without top by cutting square of side x from each corner and folding the flaps to form a box.



(i) What is the Volume of the open box formed by folding up the flap:

(ii) In the first derivative test, if $\frac{dy}{dx}$ changes its sign from positive to negative as x increases through c_1, then which value is attained by the function at $x = c_1$.

(iii) What should be the side of the square piece to be cut from each corner of the board to behold the maximum volume?

OR

(iii) Find the maximum volume of the box?

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Q39.Case-Study III - **Read the text carefully and answer the questions:**

A doctor is to visit a patient. From the past experience, it is known that the probabilities that he will come by cab, metro, bike or by other means of transport are respectively 0.3, 0.2, 0.1, and 0.4. The probabilities that he will be late are 0.25, 0.3, 0.35, and 0.1 if he comes by cab, metro, bike and other means of transport respectively.



i. When the doctor arrives late, what is the probability that he comes by metro?

ii. When the doctor arrives late, what is the probability that he comes by other means of transport?

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MARKING SCHEME

CLASS - XII (Mathematics)

SESSION 2023-24

Q.No.	Answer	Marks	Remark
1	(d)$\lambda \neq -2$	1	
2	(d)) $\frac{16}{5}$	1	
3	(a) 125	1	
4	(b) 6	1	
5	(c) ±3	1	
6	(b) -3	1	
7	(a) 1	1	
8	(c) 1	1	
9	(c) $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$	1	
10	(d) 0	1	
11	(a) 5	1	
12	(d) $\frac{2\pi}{3}$	1	
13	(d)) $\pm\sqrt{3}$	1	
14	(a) $\frac{2}{3}$	1	
15	(c) 2, -3, 6	1	
16	(d)	1	
17	(b) p = q	1	
18	(a) $\frac{1}{3}$	1	
19	(c) A is true, R is false.	1	
20	(a) Both A and R are true, but R is the correct explanation of A.	1	
	SECTION –B (2 Marks)		
21	$\sin\alpha = \frac{1}{2} \Rightarrow \alpha = \frac{\pi}{6}$ $\cos(3\pi - 2\alpha) = -cos2\alpha = -\frac{1}{2}$ $\tan^{-1}\left\{2(-\frac{1}{2})\right\} = -\pi/4$ (A)	1 1	
OR	For correct defining For correct One-one For correct onto (C) 1	1	

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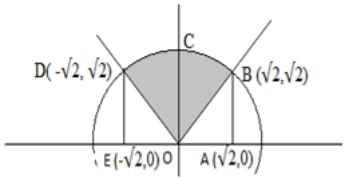
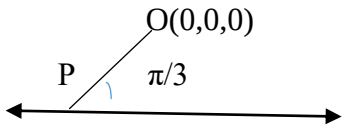
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22	For Correct logarithm For correct derivative For correct Answer (D)	 1 1	
23	For correct relation 2x=3y For given $\frac{dx}{dt} = 0.3\ m/sec$&$\frac{dy}{dt} = 0.2\ m/sec$ Rate of shadow lengthening 0.2 m/sec Rate of the tip of the shadow moving 0.5m/sec (C)	 1 1	
24	I = logx-log(x+1)+c (A)	1 1	
25	Correct Property $\int_0^a f(x)\,dx = \int_0^a (a-x)\,dx$ 2I = $\int_0^{\frac{\pi}{4}} log2\,dx$ Correct value $\frac{\pi}{8} log2$ (B)	 1 1	
26.	y - log |y + 1| = log |1 + e^x | + C or Reducing the given DE in its correct form Apply the DE Do Integration $y = c\frac{y+1}{1+e^x}$ (A)	1 1	
27	$P(\overline{A} \cap B) = P(B) - P(A \cap B)$ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ P(B)=1/3 $P(\overline{A} \cap B) = 1/6$	1 1	
28	f'(x)=2x-6=0 x=3 strictly increasing x> 3 (C)	1 1	
29	$\int \frac{1}{sin(x-a).cos(x-b)}dx$ $= \frac{1}{\cos(b-a)} \int \frac{\cos\{(x-a)-(x-b)\}}{sin(x-a).cos(x-b)}dx$	 1 1	

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	$= \frac{1}{\cos(b-a)}[\int \frac{\cos(x-a)}{\sin(x-a)}dx + \int \frac{\sin(x-b)}{\cos(x-b)}dx]$ $= \frac{1}{\cos(b-a)} log \left\|\frac{\sin(x-a)}{\cos(x-b)}\right\| + c$	1	
30	$I= -\frac{1}{2}\int \frac{-2x-4}{\sqrt{5-4x-x^2}}dx + \int \frac{1}{\sqrt{5-4x-x^2}}dx$ For Correct I= $-\sqrt{5-4x-x^2} + \sin^{-1}\frac{x+2}{3} + c$	1 1 + 1	1 for each correct Integral
OR	For I = $\int \frac{x^2}{(x^2+1)(x^2+4)}dx$ $= \frac{1}{3}[\int \frac{4}{(x^2+4)}dx - \int \frac{1}{(x^2+1)}dx]$ $= 2/3 \tan^{-1}\frac{x}{2} - \frac{1}{3}\tan^{-1}x + c$	1 ½ 1 ½	
31	Correct graph Correct vertices (0,5) , (4,3) & (0, 6) Min(Z) = 2300 at (4,3)	1 1 ½ ½	
32	LHD at x=1 RHD at x=1 Show that LHD =RHD at x=1	1 1 1	
	SECTION – D(5 marks)		
33.	$\|A\|$ = - 1 ≠0 so A^{-1} exist For finding correct cofactors Correct $A^{-1} = \begin{bmatrix} 0 & -2 & -1 \\ 1 & 9 & 5 \\ -2 & -23 & -13 \end{bmatrix}$ X= $A^{-1}B$, x= 1, y = 2 , z = 3	1 1 ½ 1 ½ 1	
34.	for $Let\ x_1, x_2 \in R_+$ f(x_1) = f(x_2) $\Rightarrow 3(x_1 - x_2)[3(x_1 + x_2) + 2] = 0$ $x_1 + x_2 \neq -\frac{2}{3} \notin R_+$ $\Rightarrow x_1 - x_2 = 0 \Rightarrow x_1 = x_2$, f is one -one Let f(x) = y $\Rightarrow 9x^2 + 6x - 5 = y$ $x = \frac{\sqrt{y+6}-1}{3}$, since $x \geq 0 \Rightarrow y \geq -5$ Range = [-5 , ∞) = Co-domain	1 1 1. 1 1	

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	OR reflexive symmetric Transitive Equivalence	1 1.5 1.5 1	
35.	correct fig  Correct area formula $= 2\left[\int_0^{\sqrt{2}} \sqrt{4-x^2}\,dx - \int_0^{\sqrt{2}} x\,dx\right]$ Correct integrals $2\left\{\left[\frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\frac{x}{2}\right] - \frac{x^2}{2}\right\}$ Correct Answer: πsq. Units	1 1 2 1	
36.	Any arbitrary point on the line P(3 + 2λ, 3 + λ , λ)  Direction ratio of OP < 3 + 2λ- 0, 3 + λ- 0 , λ- 0 > $\cos\frac{\pi}{3} = \frac{\lvert 6\lambda + 9\rvert}{\sqrt{6}\sqrt{6\lambda^2 + 18\lambda + 18}}$ $\Rightarrow \lambda^2 + 3\lambda + 2 = 0$ λ = -1 or -2 Co-ordinate of P (1,2,-1) or (-1,1,-2) Required lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{-1}$ *or* $\frac{x}{-1} = \frac{y}{1} = \frac{z}{-2}$	½ ½ 1 2 ½ ½	
OR	Any line through (1,1,1) is $\frac{x-1}{a} = \frac{y-1}{b} = \frac{z-1}{c}$ …(i) where a, b, c are d.r's it intersect $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ if a:b:c≠2;3;4 & $\begin{vmatrix} 1-1 & 2-1 & 3-1 \\ a & b & c \\ 2 & 3 & 4 \end{vmatrix} = 0$ ⇒ a – 2b + c = 0 ……(ii) Sly (i) intersect $\frac{x+2}{1} = \frac{y-3}{2} = \frac{z+1}{4}$ if a:b:c ≠1:2:4 & $\begin{vmatrix} -2-1 & 3-1 & -1-1 \\ a & b & c \\ 1 & 2 & 4 \end{vmatrix} = 0 \Rightarrow$ 6a +5b -4c=0 ..(iii) Solving (ii) & (iii) a:b:c= 3:10:17	½ 1 ½ 1 + ½ 1	

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	Required equation of line : $\frac{x-1}{3}=\frac{y-1}{10}=\frac{z-1}{17}$	½	
	SECTION –E(4 marks) Case Study		
37.	(i) $\vec{d}=\vec{a}+\vec{b}$ $\vec{s}=\vec{a}-\vec{b}$ (ii) $\sqrt{1221}$ (iii) $\sqrt{1221}$	2 1 1	
38.	(i)Volume of open box = $x(24-2x)^2$ (ii)Local max at c_1 (iii) v = $x(24-2x)^2\frac{dV}{dx}=0\Rightarrow x=4$ Therefore, side of square is 4cm. Or $v=x(24-2x)^2, put\frac{dv}{dx}=(24-2x)(24-6x)$ $=0, x=4$ $(\frac{d^2y}{dx^2})_{x=4}=-6(24-2x)-2(24-6x)=-96$ $<0, max$ V_{MAX}= 4(24-8)^2 = 1024 Sq units	1 1 1 1	Correct derivative 1
39	A: he will come by cab B: he will come by metro C: he will come by bike D: he will come by other means E: HE arrives late P(A) = 0.3, P(B) = 0.2, P(C) = 0.1, P(D) = 0.4 P(E/A) = 0.25, P(E/B) = 0.3 P(E/C) = 0.35, P(E/D) =0.1 i)P(B/E) = $\frac{0.2\times0.3}{0.3\times0.25+0.2\times0.3+0.1\times0.35+0.4\times0.1}=\frac{6}{21}=2/7$ ii) P(D/E) = $\frac{0.4\times0.1}{0.3\times0.25+0.2\times0.3+0.1\times0.35+0.4\times0.1}=\frac{4}{21}$	2 1 1	

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