DOE PRACTICE PAPER – 1 (TERM – 1) (SESSION 2021 – 22)
CLASS XII
MATHEMATICS (CODE: 041)

Time Allowed: 90 Minutes **Maximum Marks: 40**

General Instructions:

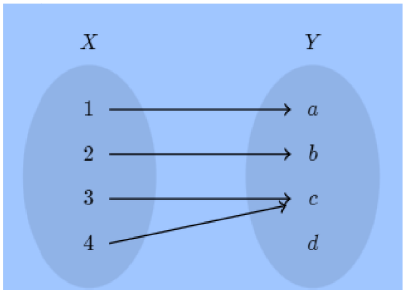
1. This question paper contains **three sections – A, B and C**. Each part is compulsory.
2. **Section - A** has **20 MCQs**, **attempt any 16 out of 20**.
3. **Section - B** has **20 MCQs**, **attempt any 16 out of 20.**
4. **Section - C** has **10 MCQs**, **attempt any 8 out of 10**.
5. There is **no negative marking.**
6. All questions carry equal marks.

	SECTION – A **In this section, attempt any 16 questions out of Questions 1 – 20.** **Each question is of 1 mark weightage.** **Each MCQ has four options with only one correct option, choose the correct option.**	
1.	The range of the function f(x) = $\tan^{-1} x + \cot^{-1} x$ is (a) [- $\frac{\pi}{2}$, $\frac{\pi}{2}$] (b) [0, π] (c) [0, $\frac{\pi}{2}$] (d) {$\frac{\pi}{2}$}	1
2.	The value of the expression $\sec^{-1}(2) + \sin^{-1}(\frac{1}{2}) + \tan^{-1}(-\sqrt{3})$ is (a) $\frac{5\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{-\pi}{3}$ (d) $\frac{\pi}{6}$	1
3.	The relation R in the set {a, b, c} given by R = {(a, a), (b, b), (a, b), (b, a)} is (a) symmetric and transitive, but not reflexive (b) reflexive and symmetric, but not transitive (c) symmetric, but neither reflexive nor transitive (d) an equivalence relation	1
4.	*A* = {1, 2, 3, 4}, A relation R in the set A is given by R = { (1, 1), (2, 3), (3, 2), (4, 3), (3, 4) }, then relation R is (a) Reflexive (b) symmetric (c) Transitive (d) Equivalence	1
5.	If A is any square matrix of order 3 × 3 such that |adj A| = 256, then the sum of all possible values of |A| is (a) 256 (b) 16 (c) – 16 (d) 0	1

6.	If $\begin{bmatrix} x-2 & 5+y \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = O$,Then x + y = (a) 0 (b) – 2 (c) – 1 (d) – 3	1
7.	If A is a diagonal matrix of order 3 x 3 such that A^2 = A, then number of possible matrices A are (a) 4 (b) 8 (c) 16 (d) 32	1
8.	If $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} + X = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}, where\ X = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$,Then $a+c-b-d =$ (a) 13 (b) 5 (c) – 8 (d) – 3	1
9.	If A is a symmetric matrix then which of the following is not Symmetric matrix, (a) $A + A^T$ (b) $A.A^T$ (c) $A - A^T$ (d) A^T	1
10.	If A is a non-singular square matrix of order 3 such that |A| = 3, then value of $\|2A^T\|$ is (a) 3 (b) 6 (c) 12 (d) 24	1
11.	If $y = \frac{1}{1+x^{b-a}+x^{c-a}} + \frac{1}{1+x^{c-b}+x^{a-b}} + \frac{1}{1+x^{a-c}+x^{b-c}}$, then $\frac{dy}{dx} =$ (a) x^{a+b+c} (b) x^{abc} (c) $\frac{1}{x^a+x^b+x^c}$ (d) 0	1
12.	Suppose P, Q and R are different matrices of order 3 × 5, a × b and c x d respectively, then value of ac + bd is, if matrix 2P + 3Q – 4R is defined (a) 9 (b) 30 (c) 34 (d) 15	1
13.	The function given below at **x =** 4 is $f(x) = \begin{cases} 2x+3, x \le 4 \\ x^2-5, x > 4 \end{cases}$ (a) Continuous but not differentiable (b) Differentiable but not continuous (c) Continuous as well as differentiable (d) Neither continuous nor differentiable	1
14.	If $x^3 - 3x^2y + y^3 = 2021 + xy$ then $\frac{dy}{dx} =$ (a) $\frac{3x^2-6xy-y}{3x^2+3y^2-x}$ (b) $\frac{3x^2-6xy-y}{3y^2-3x^2-x}$ (c) $\frac{6xy+y-3x^2}{3y^2-3x^2-x}$ (d) $\frac{3x^2-6xy-y}{3x^2+3y^2+x}$	1

15.	The slope of the tangent to the curve $y = x^3$, at the point (2, 8) is (a) 2 (b) 6 (c) 11 (d) 12	1
16.	Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0). Let Z = px+qy, where p, q > 0. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is (a) p = 2q (b) q = 2p (c) p = 3q (d) p = q	1
17.	The points on the curve $4x^2 + 9y^2 = 36$ at which tangent to the curve is parallel to x-axis, is (a) (±2, 0) (b) (0, ±2) (c) (0, ±3) (d) (±3, 0)	1
18.	The interval in which $y = - x^3 + 3x^2 + 2021$ is increasing is (a) (- ∞, ∞) (b) (0, 2) (c) (2, ∞) (d) (- 2, 0)	1
19.	If $x = \log_e y$, then $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} =$ (a) y (b) 2y (c) – 2y (d) – y	1
20.	If $x = \sin^3 t$, $y = \cos^3 t$ then $\frac{dy}{dx} =$ (a) tan t (b) cot t (c) - tant (d) – cot t	1
	SECTION – B **In this section, attempt any 16 questions out of Questions 21 – 40.** **Each question is of 1 mark weightage.** **Each MCQ has four options with only one correct option, choose the correct option.**	
21.	If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$, $\cos^{-1} x + \cos^{-1} y =$ (a) $\frac{-\pi}{3}$ (b) $\frac{\pi}{3}$ (c) π (d) $\frac{\pi}{2}$	1
22.	Let f : R → R be defined as f(x) = 7x – 5, then (a) f is one-one onto (b) f is many-one onto (c) f is one-one but not onto (d) f is neither one-one nor onto	1
23.	A relation R in the set of real numbers R is given by R = {(a, b) : a >b, a , b ∈ R}, The relation R is (a) Reflexive (b) symmetric (c) Transitive (d) Equivalence	1
24.	If $a \le 2\sin^{-1} x + c\cos^{-1} x \le b$, then (a) $a = 0, b = \pi$ (b) $a = \pi, b = 2\pi$ (c) $a = \frac{-\pi}{2}, b = \frac{\pi}{2}$ (d) $a = 0, b = \frac{\pi}{2}$	1

25.	**If** $A^{-1}=\begin{bmatrix}3 & 1 & 2\\ 0 & 1 & 2\\ 0 & 2 & 1\end{bmatrix}, then \ \ \lvert adjA\rvert =$ (a) $\frac{1}{9}$ (b) $\frac{1}{81}$ (c) -9 (d) - 81	1
26.	If A and B are two square matrices of same order such that, AB = A and BA = B, then (A + B)(A – B) = (a) $A^2 - B^2$ (b) 2A – 2B (c) 2A + 2B (d) O	1
27.	If $5^x + 5^y = 5^{x+y}$, then $\frac{dy}{dx} =$ (a) 5^{x-y} (b) 5^{y-x} (c) -5^{x-y} (d) -5^{y-x}	1
28.	The interval on which the function f (x) = $2x^3 - 3x^2 - 36x + 10$ is decreasing is (a) (- ∞, - 2) (b) (- 2, 3) (c) (2, 3) (d) (3, ∞)	1
29.	If the curve $ay + x^2 = 7$ and $x^3 = y$, cut orthogonally at (1, 1), then the value of a is: (a) 1 (b) 3 (c) – 6 (d) 6	1
30.	If $\log(\frac{x^2-y^2}{x^2+y^2}) = a$, then $\frac{dy}{dx} =$ (a) $\frac{y}{x}$ (b) $\frac{-y}{x}$ (c) $\frac{x}{y}$ (d) $\frac{-x}{y}$	1
31.	The area of a triangle with vertices (–3, 0), (3, 0) & (0, k) is 9 sq. units. The value of k is (k > 0) (a) 3 (b) 6 (c) 9 (d) 12	1
32.	**If** $\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}6\\ 3\\ 2\end{bmatrix}, then \ \ 2x+y-z=$ (a) 2 (b) 1 (c) 3 (d) 5	1
33.	If $\tan y = x,$, then $when \ x=1,$ value of $4\frac{d^2y}{dx^2}$ is (a) 2 (b) – 2 (c) 1 (d) – 1	1
34.	If a non-singular Matrix A satisfy $2A^2 + A - I = O$, then $A^{-1} =$ (a) 2A – I (b) 2A + I (c) 4A + 2I (d) 2A – 4I	1
35.	The maximum value of the function f(x) = 4.sin x. cos x is (a) 2 (b) 4 (c) 1 (d) 8	1

36.	If the objective function z = ax + y is minimum at (1, 4) and its minimum value is 13, then value of a is (a) 1 (b) 4 (c) 9 (d) 13	1
37.	Let L be the set of all lines in a plane. A relation R in L is given by R = {(L_1,L_2):L_1 and L_2 intersect at exactly one point, L_1,L_2∈L}, then the relation R is (a) Reflexive (b) Symmetric (c) Transitive (d) Equivalence	1
38.	If f : X → Y is defined, then f is  (a) Bijective function (b) Many-one and onto (c) Many-one and Into function (d) One-one but not onto	1
39.	The feasible region for an LPP is always a _____ polygon (a) Convex (b) Concave (c) either (a) or (b) (d) neither (a) nor (b)	1
40.	The tangent to the curve y = e^x at the point (0, 1) meets x-axis at (a) (1, 0) (b) (- 1, 0) (c) (0, 0) (d) (2, 0)	1

SECTION – C

In this section, attempt any 8 questions out of Questions 41 – 50.
Each question is of 1 mark weightage.

Each MCQ has four options with only one correct option, choose the correct option.

Questions 46-50 are based on a Case-Study

41.	The feasible region, for the inequalities $x + 2y \leq 6$, $y \geq 0$, $0 \leq x$ lies in (a) First Quadrant (b) Second Quadrant (c) Third Quadrant (d) Fourth Quadrant	1
42.	Which of the following function is decreasing on $(0, \frac{\pi}{2})$ (a) sin x (b) cos x (c) tan x (d) sin 2x	1
43.	If the function f(x) = sin x – ax + b, is decreasing on x ε R, then a belongs to (a) (1, ∞) (b) [0, ∞) (c) (0, ∞) (d) [1, ∞)	1
44.	In a linear programming problem, If the feasible region is bounded then objective function Z = px + qy has (a) Maximum value only (b) Minimum value only (c) Maximum and minimum value both (d) Neither maximum nor minimum value	1
45.	If $A = \begin{bmatrix} 6x & 8 \\ 3 & 2 \end{bmatrix}$ is singular matrix, then the value of x is (a) 3 (b) – 2 (c) 0 (d) 2	1

CASE STUDY

The fuel cost per hour for running a train is proportional to the square of the speed it generates in km per hour. If the fuel costs ₹ 48 per hour at speed 16 km per hour and the fixed charges to run the train amount to ₹ 1200 per hour. Assume the speed of the train as v km/h.

Based on the given information, answer the following questions.

46.	Given that the fuel cost per hour is k times the square of the speed the train generates in km/h, the value of $16k$ is: (a) 1 (b) 2 (c) 3 (d) 4	1
47.	If the train has travelled a distance of 1000 km, then the total cost of running the train is given by function: $(a)\frac{375}{4}v+\frac{60000}{v}$ $(b)\frac{375}{8}v+\frac{60000}{v}$ $(c)\frac{375}{2}v+\frac{60000}{v}$ $(d)\frac{375}{2}v+\frac{1200000}{v}$	1
48.	The most economical speed to run the train (in Km/hr) is: (a) 50 (b) 80 (c) 400 (d) 800	1
49.	The fuel cost (In Rs.)for the train to travel 1000km at the most economical speed is: (a) 15000 (b) 75000 (c) 100000 (d) 150000	1
50.	The total cost of the train to travel 1000km at the most economical speed is: (a) 15000 (b) 30000 (c) 100000 (d) 150000	1