CLASS: XII
SUBJECT: MATHEMATICS (041)

UNIT WISE PRACTICE QUESTION PAPER
(UNITS: RELATION-FUNCTION, MATRICES, DETERMINANTS)

Time: 3 Hours 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) Use of calculators is not allowed.

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SECTION A **[1×20 = 20]**

(This section comprises of Multiple –choice questions (MCQ) of 1 mark each.)

Select the correct option (Question 1 - Question 18):

Q1. A function $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = 2 + x^2$ is

(A) not one-one (B) one-one (C) not onto (D) neither one-one nor onto

Q2. The area of the triangle whose vertices are $(3,8), (-4,2)$ and $(5,1)$ is

(A) 60 (B) 61 (C)$61/2$ (D) 30

Q3. How many matrices are possible of order 2×2 with the numbers 0, 1 and 2 such that each element of the matrix is non-zero

(A)3^4 (B)2^4 (C)4^2 (D)4^3

Q4. If a relation R on a set $\{1,2,3\}$ be defined by $R = \{(1,2)\}$ then R is

(A) Reflexive (B) Transitive(C) Symmetric (D) None of these

Q5. The value of the determinant $\begin{vmatrix} x & x+1 \\ x-1 & x \end{vmatrix}$ is

(A) 1 (B) -1(C) 2(D) 0

Q6. If A is a skew matrix of odd order n then

(A) $|A| = 0$ (B)$|A| = -1$ (C) $|A| = |A'|$ (D)None of These

Q7. Let R be the relation in the set $\mathbb{N}$ given by $R = \{(a,b): a = b-2, b > 6\}$. Choose the correct answer

(A) $(2,4) \in \mathbb{R}$ (B)$(3,8) \in \mathbb{R}$ (C)$(6,8) \in \mathbb{R}$ (D)$(8,7) \in \mathbb{R}$

Q8. If the diagonal elements of a diagonal matrix are all equal then the matrix is called

(A) Row Matrix (B) Scalar Matrix (C) Rectangular Matrix (D) None of these

Q9. If $A = \begin{bmatrix} 1 & 2 & 3 \\ -4 & -5 & 6 \end{bmatrix}$ then det(A) will be

(A) 2 (B) 0 (C) -2 (D) doesn't exist

Q10. If $f: \mathbb{R} \to \mathbb{R}$ is given by $f(x) = x^3 + 3$ then $f^{-1}(x)$ is equal to

(A) $x^{1/3} - 3$ (B)$x^{1/3} + 3$ (C)$(x-3)^{1/3}$ (D)$x + 3^{1/3}$

Q11. If A is a square matrix such that $A^2 = I$ then $(A-I)^3 + (A+I)^3 - 7A$ is equal to

(A)A (B)$I - A$ (C)$I + A$ (D)$3A$

Q12. If $f(x) = 8x^3$ and $g(x) = x^{1/3}$ then

(A)$fog(x) = 2x$ (B)$fog(x) = 8x$ (C)$gof(x) = 2x^{\frac{1}{3}}$ (D)$gof(x) = x^{1/3}$

Q13. Matrices A and B will be inverse of each other if and only if

(A)$AB = BA$ (B)$AB = BA = 0$ (C)$AB = 0, BA = I$ (D)$AB = BA = I$

Q14. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to

(A) 6 (B)± 6 (C)-6 (D) 0

Q15. If $A = \{a,b,c,d\}$ and $f = \{(a,b)(b,d)(c,a)(d,c)\}$ then f^{-1} is

(A) $\{(a,b)(d,b)(a,c)(c,d)\}$ (B)$\{(b,a)(d,b)(a,c)(c,d)\}$

(C) $\{(a,b)(b,d)(c,a)(d,c)\}$ (D) does not exist

Q16. Let L is the collection of straight lines in a plane and a relation R defined as $R = \{(L_1, L_2): L_1 \parallel L_2\}$ then relation R is

(A) reflexive only (B) symmetric only (C) transitive only (D) Equivalence relation

Q17. Minor of an element of a determinant order $n(n \geq 2)$ is a determinant of order

(A)n (B)$n-1$ (C)$n-2$ (D)$n-3$

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Q18 If A and B are two square matrices of the same order and $AB = 3I$then A^{-1} is equal to

. (A)$3B$ (B)$\frac{1}{3}B$ (C)$3B^{-1}$ (D)$\frac{1}{3}B^{-1}$

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:**If A is a skew symmetric matrix then A^2 is also a skew symmetric matrix.

. **Reason:**If A is a skew symmetric matrix then $A' = -A$.

Q20 **Assertion:**Let L be the collection of all lines in a plane and R is a relation on L defined as

. $R = \{(L_1, L_2): L_1 \perp L_2\}$.

Reason:A relation R is said to be symmetric if $(a, b) \in \mathbb{R} \Rightarrow (b, a) \in \mathbb{R}$.

SECTION B **[2× 5 = 10]**

(This section comprises of 5 very short answer (VSA) type-questions of 2 marks each.)

Q21 Check if the relation R on the set $A = \{1, 2, 3, 4, 5, 6\}$ defined as $R = \{(x, y) :$

. $y \text{ is divisible by } x\}$ is symmetric or transitive.

Q22 If A and B are symmetric matrices prove that $AB - BA$ is a skew symmetric matrix.

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Q23 If $A = \begin{vmatrix} 6 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{vmatrix}$ then show that $|2A| = 8|A|$.

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Q24 If $f: \mathbb{R} \to \mathbb{R}$be defined by $f(x) = \frac{1}{x} \forall\, x \in \mathbb{R}$. Then check whether it is a function or not.

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Q25 Find the value of $x - y$ if

. $$2\begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$$

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SECTION – C [3× 6 = 18]

(This section comprises of 6 short answer (SA) type questions of 3 marks each)

Q26. Show that the relation R on $\mathbb{R}$ defined as $R = \{(a, b): a \leq b\}$ is reflexive and transitive but not symmetric.

Q27. If the area of the triangle with vertices $A(x, 4)$ $B(-2,4)$and $C(2, -6)$ is 35 sq units. Find the value of x.

Q28. If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$ then verify that $(AB)^{-1} = B^{-1}A^{-1}$.

Q29. Prove that the greatest integer function $f: \mathbb{R} \to \mathbb{R}$ given by $f(x) = [x]$ is neither one-one nor onto.

Q30. Using co-factors of elements of 3rd column evaluate $\Delta = \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$.

Q31. Construct a matrix of order 3×2 whose elements are given by $a_{ij} = e^{ix} \sin jx$.

SECTION – D [5× 4 = 20]

(This section comprises of 4 long answer (LA) type questions of 5 marks each)

Q32. Given a non-empty set X define the relation R in $P(X)$ as follows:

For $A, B \in P(X)$, $(A, B) \in R$ iff $A \subset B$. Prove that R is reflexive and transitive but not symmetric.

Q33. If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$ then show that $A^3 - 4A^2 - 3A + 11I = 0$.

Q34. Evaluate the product AB where-

$A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$

Hence solve the system of linear equations:

$$x - y = 3$$

$$2x + 3y + 4z = 17$$

$$y + 2z = 7$$

Q35. Show that the function f in $A = \mathbb{R} - \left\{\frac{2}{3}\right\}$ defined as $f(x) = \frac{4x+3}{6x-4}$ is one-one.

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SECTION – E [4× 3 = 12]

(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts)

Q36. The Palace of Peace and Reconciliation, also known as the Pyramid of peace and Accord is a 62-meterhigh Pyramid in Mursultan, the capital of Kazakhstan that serves as a non-denominational national spiritual centre and an event venue. It is designed by faster and partners with a stained glass apex. It has 25 smaller equilateral triangles as shown in the figure.

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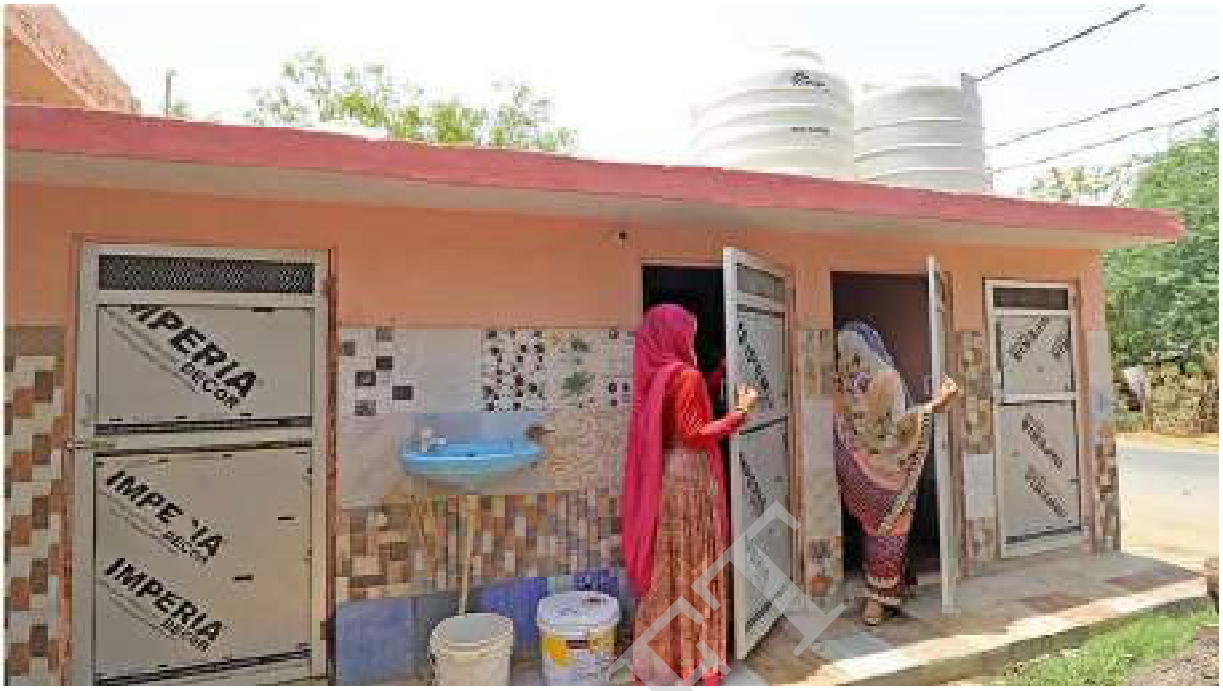
(i) If the vertices of one triangle are $(0, 0), (3, \sqrt{3})\ and\ (3, -\sqrt{3})$ then find the area. [1 Mark]

(ii) Find the area of face of the Pyramid. [1 Mark]

(iii) Find the length of an altitude of a smaller equilateral triangle. [2 Mark]

Q37. To promote the usage of house toilets in villages especially for women, an organization tried to generate awareness among the villagers through (i) house calls (ii) letters and (iii)



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The cost for each mode per attempt is (i) Rs 50 (ii) Rs 20 (iii)Rs40 respectively. The number of attempts made in the villages X, Y and Z are given below:

	(i)	(ii)	(iii)
X	400	300	100
Y	300	250	75
Z	500	400	150

Also the chance of making of toilets corresponding to one attempt of given modes is:
(i) 2% (ii) 4% (iii) 20%

Let A, B, C be the cost incurred by organization in three villages respectively. Based on the above information answer the following questions

(A) Form a required matrix on the basis of the given information. [1 Mark]

(B) Form a matrix, related to the number of toilets expected in villagers X, Y, Z after the promotion campaign. [1 Mark]

(C) What is total amount spent by the organization in all three villages X, Y and Z [2 Marks]

Q38. Maths-teacher started the lesson Relations and Functions in Class XI. He explained the following topics:

Ordered Pairs: The ordered pair of two elements a and b is denoted by (a, b) : a is first element (or first component) and b is second element (or second component).

Two ordered pairs are equal if their corresponding elements are equal. i.e., (a, b) = (c, d) ⇒ a = c and b = d.

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Cartesian Product of Two Sets: For two non-empty sets A and B, the cartesian product A x B is the set of all ordered pairs of elements from sets A and B.
In symbolic form, it can be written as $A \times B = \{(a, b) : a \in A, b \in B\}$.
Based on the above topics, answer the following questions.

(i) If $(a - 3, b + 7) = (3, 7)$, then find the value of a and b. [1 Mark]

(ii) If $(x + 6, y - 2) = (0, 6)$, then find the value of x and y. [1 Mark]

(iii) If $(x + 2, 4) = (5, 2x + y)$, then find the value of x and y. [1 Mark]

(iv) Find x and y, if $(x + 3, 5) = (6, 2x + y)$. [1 Mark]

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	$\Rightarrow x + 6 = 0$ $\Rightarrow x = -6$ and $y - 2 = 6$ $\Rightarrow y = 6 + 2 = 8$ (iii) $(x + 2, 4) = (5, 2x + y)$ $\Rightarrow x + 2 = 5$ $\Rightarrow x = 5 - 2 = 3$ *and* $4 = 2x + y$ $\Rightarrow 4 = 2 \times 3 + y$ $\Rightarrow y = 4 - 6 = -2$ (iv) $x + 3 = 6$, $2x + y = 5$ $\Rightarrow x = 3, y = 1$	1 1 1

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