MATHEMATICS

New Syllabus

Level: Class XI (Education) **Full Marks:** 100
Pass Marks: 35

Course Contents

Unit 1: Sets, Real Number System and Logic **Teaching hours: 10**

Sets:
Sets and set operations, Theorems based on set operations.

Real Number System:
Real numbers, Field axioms, Order axioms, Interval, Absolute value, Geometrical representation of the real numbers.

Logic:
Introduction, statements, Logical connectives, Truth tables, Basic laws of logic.

Unit 2: Relations, Functions and Graphs **Teaching hours: 12**

Relations:
Ordered pair, Cartesian product, Geometrical representation of Cartesian product, relation, Domain and range of a relation, Inverse of a relation.

Functions:
Definition, Domain and range of a function, Functions defined as mappings, Inverse function, Composite function, functions of special type (Identity, Constant, Absolute value, Greatest integer), Algebraic (Linear, quadratic and cubic), Trigonometric, Exponential logarithmic functions and their graphs.

Unit 3: Curve Sketching **Teaching hours: 10**

Odd and even functions, Periodicity of a function, symmetry (about x - axis, y - axis and origin) of elementary functions, Monotonocity of a function,
Sketching graphs of polynomial functions $\left(\frac{1}{x}, \frac{x^2-a^2}{x-a}, \frac{1}{x+a}, x^2, x^3\right)$
Trigonometric, exponential, logarithmic functions (simple cases only)

Unit 4: Trigonometry **Teaching hours: 10**

Inverse circular functions, Trigonometric equations and general values, properties of a triangle (sine law, Cosine law, tangent law, Projection laws, Half angle laws), the area of a triangle. Solution of a triangle (simple cases)

Unit 5: Sequence and Series, and Mathematical Induction **Teaching hours: 12**

Sequence and Series:
Sequence and series, type of sequences and series (Arithmetic, Geometric, Harmonic), Properties of Arithmetic, Geometric, and Harmonic sequences, A.M., G.M. And H.M. Relation among AM,, G.M. and H.M., Sum of infinite geometric series.

Mathematical Induction:
Sum of finite natural numbers, Sum of the squares of first n-natural numbers, Sum of cubes of first n-natural numbers. Intuition and induction, principle of mathematical induction.

Unit 6: Matrices and Determinants **Teaching hours : 8**

Matrices and operation on matrices (Review), Transpose of a matrix and its properties, Minors and Cofactors, Adjoint, Inverse matrix. Determinant of a square matrix, properties of determinants (Without proof) up to 3 x 3.

Unit 7: System of Linear Equations **Teaching hours: 8**

Consistency of system of linear equations, solution of a system of linear equations by Cramer's rule, Matrix method (row-equivalent and Inverse) up to three variables.

Unit 8: Complex Number **Teaching hours: 12**

Definition of a complex number, Imaginary unit, Algebra of complex numbers, Geometric representation of a complex number, Conjugate and absolute value (Modulus) of a complex numbers and their properties, Square root of a complex number, Polar form of a complex number, product and Quotient of complex numbers.

De Moivre's theorem and its application in finding the roots of a complex number, properties of cube roots of unity.

Unit 9: Polynomial Equations **Teaching hours: 8**

Polynomial function and polynomial equations, Fundamental theorem of algebra (without proof), Quadratic equation, Nature and roots of a quadratic equation, Relation between roots and coefficients, Formation of a quadratic equation, Symmetric roots, one or both roots common.

Unit 10: Co-ordinate Geometry **Teaching hours: 12**

Straight line:

Review of various forms of equation of straight lines, Angle between two straight lines, condition for parallelism and perpendicularity, length of perpendicular from a given point to a given line, Bisectors of the angles between two straight lines.

Pair of lines:

General equation of second degree in x and y, condition for representing a pair of lines, Homogeneous second degree equation in x and y, Angle between pair of lines, Bisectors of the angles between pair of lines.

Unit 11: Circle **Teaching hours: 10**

Equation of a circle in various forms (Centre at origin, centre at any point, general equation of a circle, circle with a given diameter), Condition of Tangency at a line at a point to the circle, Tangent and normal to a circle.

Unit 12: Limit and Continuity **Teaching hours: 10**

Limits of a function, Indeterminate forms, Algebraic properties of limits (without proof), Theorem on limits of algebraic, Trigonometric, Exponential and logarithmic functions

$$\left(\lim_{x\to a}\frac{x^n-a^n}{x-a}\ \lim_{x\to a}\frac{\sin x}{x},\ \lim_{x\to 0}\frac{e^x-1}{x},\ \lim_{x\to 0}\frac{\log(1+x)}{x}\right)$$

Continuity of a function, Types of discontinuity, Graph of discontinuous function.

Unit 13: The Derivatives **Teaching hours: 8**

Derivative of a function, Derivatives of algebraic, trigonometric, exponential and logarithmic functions by definition (simple forms), Rules of differentiation, Derivatives of parametric and implicit functions, Higher order derivatives.

Unit 14: Applications of Derivatives **Teaching hours: 12**

Geometric interpretation of derivative, Monotonocity of a function, Interval of monotonocity, Extrema of a function, Concavity, Points of inflection, Derivative as rate measure.

Unit 15: Anti-derivatives and its Applications **Teaching hours: 10**

Antiderivative, Integration using basic integrals, Integration by substitution and by parts method, the definite integral, The definite integral as an area under the given curve, Area between two curves.

MODEL QUESTION

HSEB Examination 2069 (2012)

Time: 3 hrs | Full Marks: 100
Pass Marks: 35

Group 'A'

Attempt all the questions. **5x3x2= 30**

1. (a) Define negation of a statement. Construct a truth table for the compound statement $\sim(p \vee (\sim q))$. **[From Unit 1]**

   (b) Find the domain of the function $y = \sqrt{x-2}$. **[From Unit 2]**

   (c) Test the periodicity of the function $f(x) = \sin 2x$ and find the its period. **[From Unit 3]**

2. (a) Solve : $\sin x - \cos x = \sqrt{2}$. **[From Unit 4]**

   (b) Use the principle of mathematical induction: **[From Unit 5]**
   $2+4+6+ \ldots\ldots\ldots\ldots\ldots +2n=n(n+1)$.

   (c) If $A = \begin{bmatrix} 4 & -5 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$ Find $(AB)^T$. **[From Unit 6]**

3. (a) Using Cramer's rule, solve the following equations: **[From Unit 7]**
   $x - 2y = -7$
   $3x + 7y = 5$

   (b) If W be a complex cube root of unity, find the value of: **[From Unit 8]**
   $(1 - w + w^2)^4 (1 + w - w^2)^4$

   (c) For what values of p will the equation $5x^2 - px + 45 = 0$ have equal roots. **[From Unit 9]**

4. (a) Find the equation of a line through (5,4) and perpendicular to the line $4x-3y=10$. **[From Unit 10]**

   (b) Find the equation of the circle concentric with the circle $x^2 + y^2 - 8x + 12y + 15 = 0$ and passing through (5,4). **[From Unit 11]**

   (c) Evaluate: $\lim_{x \to \infty} (\sqrt{x} - \sqrt{x-3})$ **[From Unit 12]**

5. (a) Find $\frac{dy}{dx}$ if $x^3+y^3 - 3axy = 0$. **[From Unit 13]**

   (b) Evaluate: $\int \cot x (\log \sin x)^3 \, dx$ **[From Unit 15]**

   (c) The side of a square sheet is increasing at the rate of 5cm/mim. At what rate is the area increasing when the side is 12 cm. long? **[From Unit 14]**

Group 'B

5x2x4=40

6. (a) Define union and intersection of two sets. If A, B and C are any three non-empty sets, prove that: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$. **[From Unit 1]**

   Or

   If $X \in R$ and a is any positive real number,
   Prove that $|x| < a \Rightarrow -a < x < a$ and conversely.

   (b) Draw the graph of the function $y = x2 - 4x + 3$ using its different characteristics. **[From Unit 2]**

7. (a) If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, show that: **[From Unit 3]**
   $x^2 + y^2 + z^2 + 2xyz = 1$

   Or,

   State sine law. Prove that: $\tan \frac{1}{2}(B - C) = \frac{b - c}{b + c} \cot \frac{A}{2}$.

   (b) Show that: $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$. **[From Unit 6]**

8. (a) Using row equivalent matrix method or inverse matrix method, solve the following equations. **[FromUnit7]**

$x - 2y - z = -7$

$2x + y + z = 0$

$3x - 5y + 8z = 13$

(b) Prove that a quadratic equation cannot have more that two roots. **[From Unit 9]**

9. (a) Find the equation of the tangent to the circle $x^2 + y^2 - 2x - 4y - 4 = 0$ which are perpendicular to $3x - 4y = 1$. **[From Unit 11]**

(b) Evaluate: $\lim_{x \to \theta} \frac{x\cos\theta - \theta \cos x}{x - \theta}$ **[From Unit 12]**

Or

Define continuity of a function at a point. A function is defined as follows:

$$f(x) = \begin{cases} \frac{2x2 - 18}{x - 3} & \text{for } x \neq 3 \\ k & \text{for } x = 3 \end{cases}$$

find the value of k so that f(x) is continuous at x = 3. **[From Unit 12]**

10. (a) Find from first principles the derivative of $\sqrt{2x+3}$. **[From Unit 13]**

(b) Find the area of the region between the curve $y^2 = 16x$ and the line $y = 2x$. **[From Unit 14]**

Group 'C' 5x6=30

11. Define one to one function and onto function. Let a function f : A → B be defined by $f(x) = \frac{x^2}{6}$ with A = {-2, - 1, 0, 1, 2} and B = $\{0, \frac{1}{6}, \frac{2}{3}\}$.

Find the range of f. Is the function f one to one and onto both? **[From Unit 2]**

12. Find the sum of n terms of the series $3.1^2 + 4.2^2 + 5.3^2 + \ldots\ldots\ldots\ldots$ **[From Unit 5]**

13. If p and P^1 be the lengths of the perpendiculars from origin upon the straight lines whose equations are $x \sec\theta + y \operatorname{cosec}\theta = a$ and $x\cos\theta - y\sin\theta = a\cos 2\theta$

Prove that : $4p^2 + p^{1^2} = a^2$. **[From Unit 10]**

Or,

Show that the homogeneous equation of degree two always represents a pair of straight line passing through the origin. Also, find the angle between them. **[From Unit 10]**

14. If $z_1 = r_1(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = r_2(\cos\theta_2 + i\sin\theta_2)$, prove that :

$z_1z_2 = r_1r_2\{\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)\}$ and $\frac{z_1}{z_2} = \frac{r_1}{r_2}\{\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)\}$ **[From Unit 8]**

Or,

Define complex number. Express a complex number into polar form. State De-Moivre's theorem. Using De'Moivre's theorem, find the cube roots of unity. **[From Unit 8]**

15. What are the criteria for a function y = f(x) to have the local maxima and local minima at a point? Find the local maxima and local minima of the function $f(x) = 4x^3 - 6x^2 - 9x + 1$ on the interval (-1, 2). Also find the point of inflection. **[From Unit 14]**

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1 Sets, Real Number System and Logic

Q.No.6A (2070) 'D'

Define union and intersection of two sets. If A, B and C are three non-empty sets: prove that:

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

Q.No.1B (2070) 'D'

Let A = {a, b}, b = {b, c} and C = {c, d}. Find:

$A \times (B \cup C)$ and $A \times (B \cap C)$.

Q.No.1A (2070) 'D'

If p and q are any two statements, prove that: $p \vee q \equiv q \vee p$.

Q.No.6A, Or (2070) 'C'

Let A = [-3, 1] and B = [-2, 4]. Find $A \cup B$, $A \cap B$, A – b and B – A.

Q.No.6A (2070) 'C'

Define union and intersection of two sets. If A, B and C are any three non-empty sets, prove that:

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Q.No.1B (2070) 'C'

Let A = {1, 2, 3, 4}. Find the relation on A satisfying the condition $x + y \le 4$.

Q.No.1A (2070) 'C'

Prepare a truth table for the compound statement P v ~ (p^q).

What would you conclude from the truth table?

Q.No. 6A (2069) Supp.

If A, B and C are three non-empty sets, prove that:

$A - (B \cap C) = (A - B) \cup (A - C)$

Q.No.1B (2069) Supp.

Let A = {a, b}, B = {b, c} and C = {c, d}. Find $A \times (B \cup C)$ and $A \times (B \cap C)$.

Q.No.1A (2069) Supp.

Define disjunction of two functions. Construct a truth table for the compound statement *(~p) v (~q)*.

Q.No. 6A, Or (2069) Set 'B'

Define absolute value of a real number. For any two real numbers x and y,

Prove that: $|x + y| \le |x| + |y|$.

Q.No. 6A (2069) Set 'B'

Define De-Morgan's law. For any non-empty sets, A, B, C prove:

$A-(B \cup C) = (A-B) \cap (A - C)$.

Q.No. 1A (2069) Set 'B'

Write inverse and converse of the statement 'if 3 is an odd number then 6 is not an odd number'.

Q.No. 6A .Or (2069) Set 'A'

If x R and a is any positive real number,

Prove that: $|x| < a \Rightarrow -a < x < a$ and conversely.

Q.No. 6A (2069) Set 'A'

Define union and intersection of two sets. If A, B and C are any three non- empty sets, prove that: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.

Q.No. 1A (2069) Set 'A'

Define negation of a statement. Construct a truth table for the compound statement. ~(pv(~q)).

Q.No.6a. Or (2068)

Define absolute value of a real number. Rewrite the following relation without using absolute value sign $|2x-1| \leq 5$.

Also, draw the graph of the inequality.

Q.No.6a (2068)

If A, B and C be any three non-empty sets,

Prove that: $A - (B \cup C) = (A - B) \cap (A - C)$.

Q.No.1b (2068)

Let A (1,2,3,4) and B = {1,3,5}. Find the relation R from Set A to Set B determined by the condition $x > y$.

Q.No. 1a (2068)

Define disjunction of two statements. Prepare a truth table for the compound statement $\sim(p \vee q)$.

Q.No. 7a (2067)- 4 Marks

In a group of students 30 study maths, 24 study physics, 22 study chemistry, 14 study maths only, 8 study physics only, 6 study maths and chemistry only, 2 study maths and physics only and 8 study none. How many students are in the group? How many study chemistry only ? How many study all three subjects?

Q.No. 1a (2067)- 2 Marks

Define Power set. Write the power set of the set A {a, b, c}.

Q.No. 7a (2066)

Twenty three medals are awarded for folksongs, eight for Deuda songs and eleven for Maithili songs. If the total number of singers awarded is thirty two and only three singers received medals in all three types of songs, find how many singers received medals in exactly two of three types of songs.

Q.No. 1a (2066)

Given A = {1, 2, 3} and B = {3, 4, 5, 6}, show that $A-(A-B) = A \cap B$.

Q.No. 7a (2065)

Out of a group of 20 teachers in a school, 10 teach Maths, 9 teach Physics, 7 teach Chemistry, 4 teach Maths and Physics, but none teach both Maths and Chemistry:

(i) How many teach Physics and Chemistry?

(ii) How many teach only Physics?

(iii) How many teach only Chemistry?

Q.No. 1a (2065)

Given A = [-2, 4] and B = [2, 5], compute $A \cup B$ and $A \cap B$.

Q.No. 7a (2064)

A village has total population 25,000 out of which 13,000 read 'Gorkhaptra' and 10,500 read 'Kantipur' and 2500 read both papers. Find the percentage of population who read neither of these papers.

Q.No. 3c (2064)

Write $|x - 7| < 3$ without using the modulus sign.

Q.No.1a (2064)

Find $A \cup B$ if: $A = \{x : x=2n+1, n \leq 5, n \in N\}$

$B = \{x : x=3n-2, n \leq 4, n \in N\}$

Q.No.7a (2063)

Of the number of three athletic teams, 21 are in the basketball team, 26 in hockey team and 29 in football team, 14 play hockey and basketball, 15 play hockey and football, 12 play football and basketball, and 8 play all the games. How many members are there in all?

Q.No.3c (2063)

Write the following by using the modulus sign: $-1 \leq x \leq 5$

Q.No.1a (2063)

Find $A \cap B$ if: $A = \{x: x = 2n+1, n \leq 6, n \in N\}$, $B = \{x: x = 3n - 2, n \leq 3, n \in N\}$

Q.No.7a (2062)

Define Union and Intersection of two sets. Illustrate them through Venn-diagrams. Let A, B, C be any non-empty subsets of U, prove that:

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.

Q.No.1a (2062)

If $A = \{1, 3, 5, 7\}$ & $B = \{2, 3, 5\}$, find $A \cap B$ and A - B. Show them in Venn-diagram.

Q.No.7a (2061)

In a group of twenty eight teachers of a school, 15 teach English, 15 teach Maths, 14 teach Nepali, 7 teach English and Maths, 6 teach English and Nepali, 5 teach Maths and Nepali. Find how many teach all three subjects, how many teach Maths only and Nepali only.

Q.N 1a (2061)

If U = {1, 2, 3, 4, 5, 6, 7, 8, 9) be the universal set and M = {1, 3, 5, 7}, N = {2, 4, 6, 8}, then find $\overline{M \cup N}$ and $\overline{M \cap N}$.

Q.No.7a (2060)

In a group of students 24 study Maths, 30 study Biology, 22 study physics; 8 study Maths only, 14 study Biology only, 6 study Biology and Physics only, and 2 study Maths and Biology only.

Find: (i) how many study all three subjects.

(ii) how many students were in the group.

Q.No.1a (2060)

If 0 = {1, 3, 5, 7, 9} and P = {2, 3, 5, 7}, find $0 \cap P$ and P - 0 with the help of Venn diagram.

Q.No.7a (2059)

In a certain village in Nepal, all the people speak Nepali or Tharu or both languages. If 90% speak Nepali and 20% Tharu language, how many speak:

(i) Nepali only (ii) Tharu language only and (iii) both languages.

Q.No.1a (2059)

If A = {a, e, i, o u} and B = {a, b, c, d, e} are two given sets, find $A \cup B$ and A - B.

Q.No.7a (2058)

If A, B, C are subsets of a universal set U, prove that,

$A - (B \cap C) = (A - B) \cup (A - C)$

Q.No.1a (2058)

If U = {1,2 .... 10), A = {x:x, ≥4}, B = {x:x < 8), find $A \cap B$ & A - B.

Q.No.7a (2057)

Define the complement of a set. State and prove De-Morgans' laws.

Q.No.1a (2057)

Prove that for any positive real number a, $|x| < a$ implies $-a < x < a$.

Q.No.7a (2056)

Define the union and the intersection of two sets. If A, B and C are subsets of U, Prove: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

Q.No.1b (2056)

Rewrite, without using absolute value sign for $|3x + 2| < 1$.

Q.No.1a (2056)

If A = {a, e ,i}, B = {e, u), U = {a, e, I ,o, u}, find $\overline{A \cup B}$ and $\overline{A \cap B}$.

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2 | Relations, Functions And Graphs

Q.No.11 (2070) 'D'

Define composite function of two functions f and g. Let $f: R \to R$ and $g: R \to R$ be two functions defined by $f(x) = 2x^2 - 3$ and $g(x) = 3x + 2$. Determine (fog) (x), (gof) (x) and (gog) (x). Is (fog) (x) = (gof) (x)? Are the functions (fog) (x) and (gog) (x) one to one?

Q.No.6a. Or (2070) 'D'

Solve the inequality: $6 + 5x - x^2 \geq 0$.

Q.No.11 (2070) 'C'

Let a function $f: A \to B$ be defined by $f(x) = \frac{x+1}{2x-1}$. Find the range of f. Is the function f one to one and onto both? If not, how can the function be made one to one and onto both?

Q.No.11 (2069) Supp.

Define composite function of $f = R \to R$ and $g = R$ and $g = R \to R$ be defines by $f(x) = 3x^2 - 4$ and $g(x) = 2x - 5$.

Find (gof) (x), (fog) (x) and (fof) (x). Is (gof) x = (fog) x? Is the composite function (gof) (x) one to one? Give reason.

Q.No.6a. Or (2069) Supp.

Solve the inequality $|2x+1| \geq 3$ and draw its graph.

Q.No.11 (2069) Set 'B'

Define function. State the condition for a function to be bijective. Given f(x) = x3+ 5, $x \in R$, find f^{-1}

Q.No.1b (2069) Set 'B

Find the domain, range and inverse of the relation R = {(1, 2), (2, 4), (3, 6), (4, 8)}

Q.No.11 (2069) Set 'A'

Define one to one function and onto function. Let a function $f: A \to B$ be defined by $f(x) = \frac{x^2}{6}$ with A = {-2, -1,0, 1, 2} and B = $\{0, \frac{1}{6}, \frac{2}{3}\}$.

Find the range of f. Is the function f one to one and onto both?

Q.No.6b (2069) Set 'A'

Draw the graph of the function $y = x^2 - 4x + 3$ using its different characteristics.

Q.No.1b (2069) Set 'A'

Find the domain of the function $y = \sqrt{x-2}$

Q.No.11 (2068)

Define the domain and the range of a function. Find the domain and the range of the function $f(x) = -x^2 + 4x - 3$.

Q.No.7b (2067) - 4 marks

For the function $f(x) = 2x^2 - 3$ and $g(x) = 3x + 2$, $x \in R$ examine whether fog and gof are one-one.

Q.No.1b (2067) - 2 marks

If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$, prove that xyz = 1.

Q.No.7b (2066)

Let R be the set of real numbers. Show that the function $F: R \to R$ such that f(x) = 5x-3 for all $x \in R$ is one to one and onto.

Q.No.1b (2066)

Prove that $\log_a x^2 - 2\log_a \sqrt{x} = \log_a x$.

Q.No.7B (2065)

If f, g: R→R defined by, $f(x) = x^3 + 2$ and $g(x) = 4x-1$, find fog(x) and gof(x), and show that the composite function is not commutative.

Q.No.1B (2065)

Let $f : R \to R$ be defined by $f(x) = 2x + 5$. Compute $f^{-1}(x)$.

Q.No.7B (2064)

Let Q be the set of all rational numbers. Show that the function:

$f : Q \to Q$ such that $f(x) = 3x + 5$ for all $x \in Q$ is one to one and onto. Find f^{-1}.

Q.No.1B (2064)

Let f, g be real valued functions defined as:

$f(x) = 4x+7, x \in R$ and

$g(x) = 5x - 2, x \in R$

find fog (x) and gof (x)

Q.No.7B (2063)

Let R be the set of rational numbers. Show that the function defined by $f : R \to R$ such that

$f(x) = 4x-7$

$x \in R$ is one-one and onto. Find a formula for f^{-1}.

Q.No.1B (2063)

Let f, g be real valued function defined as:

$f(x) = x^2+5x+7, x \in R$ and

$g(x) = 5x-3, x \in R$

find fog(x) and gof (x).

Q.No.7B (2062)

When does an inverse of a function exist? If $f : R \to R$ be defined by $f(x) = x^3 + 5$, find the formula that defines f^{-1}.

Q.No.1B (2062)

Check whether the function $f : [-2,3] \to R$ given by $f(x) = x^3$ is one to one, onto or both.

Q.No.7B (2061)

For the functions $f(x) = 2x^2 - 3$ and $g(x) = 3x + 2$ where $x \in IR$, determine fog (x), gof(x). Are (fog) and (gof) one-one?

Q.No.1B (2061)

Let $h : R \to R$ be defined by $h(x) = 3x - 6$, find a formula that defines h^{-1}.

Q.No.7B (2060)

Let $f : R \to R$ is defined by $f(x) = 2x + 3$ and

$g : R \to R$ is defined by $g(x) = x^2$, find (gof)x and (fog)x.

Q.No.1C (2060)

Define even and odd functions with examples.

Q.No.7B (2059)

Let f : R→,R and g: R→R be defined by $f(x) = x^2+1$ and $g(x) = x^5$, find f^{-1} (gof) (x); (fog) (x)

Q.No.1C (2059)

Let $f : R \to R$ be defined by $y = f(x) = 2x - 3$, $X \in R$, find formula that defines f^{-1}.

Q.No.7B (2058)

Check whether the function 1= [-2, 3] → R given by $f(x) = x^3$ is one to one, onto or both.

Q.No.1B (2058)

Let $f : A \to R$ be given by $f(x) = 2|x|+3$

Where A = {-2,0,i,2,}, find the range of f.

Q.No.7B (2057)

A function f (x) is defined as follows:

$$f(x) \begin{cases} = 4x - 2 \text{ for } x \geq 1 \\ = 2x \quad \text{for } x \angle 1 \end{cases}, \quad \text{find } f(2) : f(1) ; f(o) ; f(-1) ; \frac{f(h)-f(1)}{h} \text{ for } 1 \leq h.$$

Q.No.13 (2057)

When does a function f : A → B become an onto and one to one?

Q.No.7B (2056)

Let f : R→R and g: R→R be defined by $f(x)= x^2+1$; $g(x) = x^5$.
find f^{-1} (gof) (x) and (fog) (x).

□□□

3 Curve Sketching

Q.No.6B (2070) 'D'

Using different characteristics. Sketch the graph of : $y = (x - 1) (x - 2) (x - 3)$.

Q.No.1c (2070) 'D'

Test the even or odd nature and the symmetricity of the function $f(x) = x^4 + 3x^2 + 1$.

Q.No.6B (2070) 'C'

Using different characteristic, sketch the graph of : $y = -x^2 + 4x - 3$.

Q.No.1c (2070) 'C'

Examine whether the function:

$f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$ is even of odd. Also examine for its symmetricity.

Q.No.6B (2069) Supp.

Draw the graph of the function $f(x) = x^2 - 2x - 3$ with its different characteristics.

Q.No.1c (2069) Supp.

Test the periodicity of the function $f(x) = \cos \pi x$ and find its period.

Q.No.6B (2069) Set B

Sketch the graph of $f(x) = (x- 4)^2 -8$ indicating its characteristics.

Q.No.1c (2069) Set 'B'

Examine the function $y = \cos x$ for symmetry and even or odd nature.

Q.No.7A .Or (2069) Set A

State sine law. Prove that: $\tan \frac{1}{2}(B-C) = \frac{b - c}{b + c} \cot \frac{A}{2}$

Q.No.7A (2069) Set 'A'

If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, show that:

$x^2 + y^2 + z^2 + 2xyz = 1$

Q.No.1c (2069) Set 'A'

Test the periodicity of the function $f(x) = \sin 2x$ and find its period.

Q.No.6B (2068)

Draw the graph of $y = \cos x \left(-\frac{\pi}{2} \leq x \geq \frac{\pi}{2}\right)$ using its different characteristics.

Q.No.1c (2068)

Test the periodicity and the symmetricity of the function $y = \sin x$.

□□□

Q.No.7a. Or (2070) 'D'

If $a^4 + b^4 + c^4 = 2c^2(a^2 + b^2)$, prove that : $C = 45°$ or $135°$.

Q.No.7a (2070) 'D'

Solve : $\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0$.

Q.No.2a (2070) 'D'

Prove that : $\cos(\sin^{-1} u + \cos^{-1} v) = v\sqrt{1 - u^2} - u\sqrt{1 - v^2}$

Q.No.7a .Or (2070)'C'

State sin law. Using sine law, prove that:

$\tan\frac{1}{2}(C - A) = \frac{c - a}{c + a}\cot\frac{B}{2}$

Q.No.7a (2070)'C'

Solve : $\sin x + \cos x = \sqrt{2}$ $(-2\pi \le x \le 2\pi)$.

Q.No.2a (2070) 'C'

Prove that : $\tan^{-1}a - \tan^{-1}c = \tan^{-1}\frac{a-b}{1+ab} + \tan^{-1}\frac{b-c}{1+bc}$

Q.No.7a. Or (2069) Supp.

If $\frac{1}{a+c} + \frac{1}{b+c} = \frac{2}{a+b+c}$, show that $C = 60°$.

Q.No.7a (2069) Supp.

If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \frac{\pi}{2}$ prove that: $xy + yz + zx = 1$.

Q.No.2a (2069) Supp.

Solve: $2\cos^2 x + 4\sin^2 x = 3$.

Q.No.7a .Or (2069) Set 'B'

If $a = 2$, $b = 1 + \sqrt{3}$, $C = 60°$, solve the triangle ΔABC.

Q.No.7a (2069) Set 'B'

If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi$ show that:

$x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$

Q.No.2a (2069) Set 'B'

Solve: $\tan 2x = \tan x$ $(-\pi \le x \le \pi)$.

Q.No.2a (2069) Set 'A'

Solve: $\sin x - \cos x = \sqrt{2}$

Q.No.7a. Or (2068)

State Cosine Law, using Cosine Law,

Prove that: $\cos\frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}$

Q.No.7a (2068)

Prove that:

$\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3 = \pi = 2\left(\tan^{-1} 1 + \tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3}\right)$

Q.No.2a (2068)

Solve: $\cot x + \tan x = 2$ $(0 \le x \le \pi)$

Q.No.8b, Or (2067) – 4 marks

In any triangle ΔABC if $8R^2 = a^2 + b^2 + c^2$, prove that the triangle is right angled.

Q.No.8b (2067) - 4 marks

In any triangle ΔABC, $b = \sqrt{3}$, $C = 1$ and $A = 30°$, solve the triangle.

Q.No.1c (2067) – 2 marks

In any triangle if $\cos B = \dfrac{\sin A}{2\sin C}$, prove that the triangle is isosceles.

Q.No.8b ,Or (2066)

In a ΔABC, if $(\sin A + \sin B + \sin C)(\sin A + \sin B - \sin C) = 3\sin A \sin B$ then prove $\angle C = 60°$.

Q.No.8b (2066)

If $A = 30°$, $B = 45°$, $a = 6\sqrt{2}$, solve the triangle ΔABC.

Q.No.1C (2066)

Show that $\dfrac{b-c}{r_1} + \dfrac{c-a}{r_2} + \dfrac{a-b}{r_3} = 0$

Q.No.8b, Or (2065)

In any triangle ABC, $b = \sqrt{3}$ $c = 1$ and $\angle A = 30°$, solve the triangle.

Q.No.8b (2065)

In any triangle, state and prove Cosine law.

Q.No.1c (2065)

Show that : $\dfrac{1}{r_1} + \dfrac{1}{r_2} + \dfrac{1}{r_3} = \dfrac{1}{r}$

Q.No.8b, Or (2064)

If the angles of a triangle are to one another as 1 : 2 : 3, prove that the corresponding sides are $1 : \sqrt{3} : 2$.

Q.No.8b (2064)

In any triangle, prove that:

$a \cos A + b \cos B + c \cos C = 4R \sin A \sin B \sin C$

Q.No.1c (2064)

In a ΔABC, prove that = $\dfrac{c - b\cos A}{b - c\cos A} = \dfrac{\cos B}{\cos C}$

Q.No.8b (2063)

In any triangle, prove that $r_1 + r_2 + r_3 - r = 4R$

Q.No.1c (2063)

In a ΔABC, prove that: $(b+c)\cos A + (c+a)\cos B + (a+b)\cos C = a + b + c$

Q.No. 8b, Or (2062)

In any ΔABC, $a = 2$, $b = \sqrt{6}$ and $c = \sqrt{3} - 1$, find $\angle B$.

Q.No.8b (2062)

In any Δ ABC, prove that: $\dfrac{\cos B - \cos C}{\cos A + 1} = \dfrac{c-b}{a}$

Q.No.1c (2062)

Prove that $r r_1 r_2 r_3 = \Delta 2$

Q.No.8b (2061)

In any triangle ABC, prove that

$$\frac{a^2 \sin(B-C)}{\sin B + \sin C} + \frac{b^2 \sin(C-A)}{\sin C + \sin A} + \frac{c^2 \sin(A-B)}{\sin A + \sin B} = 0$$

Q.No.8b. or (2061)

In any triangle ΔABC, if $A = 30°$ and $B = 90°$, find a: b : c

Q.No.1c (2061)

In any triangle ΔABC, if $\text{Cos } B = \frac{\text{Sin } A}{2\text{Sin} C}$, show that the triangle is isosceles.

Q.No.8b. Or (2060)

In any triangle ΔABC, $b = \sqrt{3}$, $C = 1$ and $A = 30°$
Solve the triangle.

Q.No.8b (2060)

Prove that, in any triangle ΔABC,
$\frac{b^2-c^2}{a^2}$, Sin $2A+\frac{c^2-a^2}{b^2}$, Sin $2B+\frac{a^2-b^2}{c^2}$, Sin2C = 0

Q.No.1b (2060)

In any triangle ABC, prove that $\text{Sin } A + \text{Sin } B + \text{Sin } C = \frac{s}{R}$

Q.No.8b. Or (2059)

Solve the triangle, if $a = 2$, $b\sqrt{6} = c = \sqrt{3} + 1$.

Q.No.8b (2059)

In any triangle ΔABC prove: $\tan\frac{1}{2}(B-C) = \frac{b-c}{b+c} \cot\frac{A}{2}$

Q.No.1b (2059)

Prove that: $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{r}$

Q.No.8b. Or (2058)

If $a = 2$, $b = \sqrt{6}$, $c = \sqrt{3} + 1$, solve the triangle.

Q.No.8b (2058)

In any ΔABC prove that, $\frac{a}{\text{Sin } A} = \frac{b}{\text{Sin } B} = \frac{c}{\text{Sin } C}$

Q.No.1c (2058)

Prove that : $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{r}$

Q.No.8b. Or (2057)

Solve the triangle if $a = \sqrt{6}$, $b = 2$ and $c = \sqrt{3} - 1$.

Q.No.8b (2057)

If S be the area on incircle and S_1, S_2, S_3, are areas of excircles,
Show that : $\frac{1}{\sqrt{S_1}} + \frac{1}{\sqrt{S_2}} + \frac{1}{\sqrt{S}} - \frac{1}{\sqrt{S_3}}$

Q.No.1c (2057)

Prove that : $\text{Cos}\frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}$

Q.No.8b .Or (2056)

If three sides of a triangle are in the ratio $2 : \sqrt{6} : \sqrt{3} + 1$, Find the angles.

Q.No.8b (2056)

If $a^4+b^4+c^4 = 2c^2(a^2+b^2)$ prove that $\angle C = 45°$ or $135°$

Q.No.1c (2056)

Prove that: $r_1 r_2 + r r_3 = ab$

Q.No.8a .Or (2067) - 4 Marks

Solve for general values of x : $2 \sin^2 x + \sin^2 2x = 2$

Q.No.8a (2067) - 4 Marks

If $\sin^{-1}x + \sin^{-1}y + \sin^{-1} z = \pi$, prove that,

$x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$

Q.No.2a (2067) 2 Marks

Show that $\tan^{-1} x = \frac{1}{2} \sin^{-1} \frac{2x}{1+x^2}$

Q.No.2b (2066)

Prove that $\cos^{-1}(-x) = \pi - \cos^{-1}x$

Q.No.8a. Or (2066)

Solve for general values of θ $\tan(\theta + \alpha). \tan(\theta - \alpha) = 1$.

Q.No.8a (2066)

If $\cot^{-1}x + \cot^{-1}y + \cot^{-1}z = \pi$, show that $xy + yx + zx = 1$

Q.No.8a.Or (2065)

Solve $\sin\theta + \sin2\theta + \sin3\theta = \cos\theta + \cos2\theta + \cos3\theta$

Q.No.8a (2065)

If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, show that $x + y + z\, xyz$.

Q.No.2a (2065)

Prove that: $\sec^{-1} x + \operatorname{cosec}^{-1} x = \frac{\pi}{2}$

Q.No.8a. Or (2064)

If $\sin 2x = 3 \sin 2y$, prove that $2 \tan(x-y) = \tan(x + y)$

Q.No.8a (2064)

Find the general values of x when,

$\cos x + \sin x = \cos 2x + \sin 2x$

Q.No.2a (2064)

Prove that:

$$\tan^{-1}\left(\frac{a-b}{1+ab}\right) + \tan^{-1}\left(\frac{b-c}{1+bc}\right) + \tan^{-1}\left(\frac{c-a}{1+ca}\right) = 0$$

Q.No.8a.Or (2063)

Prove that:

$$\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3 = 2\left(\tan^{-1}1 + \tan^{-1}\tfrac{1}{2} + \tan^{-1}\tfrac{1}{3}\right).$$

Q.No.8a (2063)

Find the general values of x, when:

$\sin2x \tan x + 1 = \sin2x + \tan x$

Q.No.2a (2063)

Prove that: $\tan^{-1}\left(\frac{\sin x}{1+\cos x}\right) = \frac{x}{2}$

Q.No.8a. Or (2062)

Solve: $\tan^2 x = \sec x + 1$

Q.No.8a (2062)

Solve: $\cos3x + \cos2x = \sin\frac{3}{2}x + \sin\frac{x}{2}, 0 \le x \le \pi$.

Q .No.2a (2062)

Solve: $\cos(\sin^{-1}x) = \frac{1}{2}$

Q.No.8a. Or (2061)

Solve for general values of x : $\cos x + \cos 2x + \cos 3x = 0$

Q.No.8A (2061)

If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, prove that $x + y + z = xyz$.

Q.No.2A (2061)

Solve : $2\tan^{-1}x = \text{Sin}^{-1}\frac{2m}{1+m^2} + \text{Sin}^{-1}\frac{2n}{1+n^2}$

Q.No.8A ,Or (2060)

Solve for general values of x : $7\,\text{Sin}^2 x + 3\,\text{Cos}^2 x = 4$.

Q.No.8A (2060)

Prove that: $\text{Cot}^{-1}(\tan 2x) + \text{Cot}^{-1}(\tan 3x) = x$.

Q.No.2A (2060)

Show that : $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3} = \frac{\pi}{4}$

Q.No.8A.Or (2059)

Solve: $\cot x + \tan x = 2$.

Q.No.8A (2059)

Prove: $\tan(2\tan^{-1}x) = 2\tan(\tan^{-1}x + \tan^{-1}x^3)$.

Q.No.2A (2059)

Show that $\tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{7} = \tan^{-1}\frac{6}{17}$.

Q.No.8A.Or (2058)

Solve: $\tan^2 x = \sec x + 1$.

Q.No.8A (2058)

Prove that $\cot^{-1}3 + \text{cosec}^{-1}\sqrt{5} = \frac{\pi}{4}$

Q.No.2A (2058)

Find the value of $\tan^{-1}3 + \tan^{-1}\frac{1}{3}$

Q.No.8A. Or (2057)

Find the value of $\text{Cos}\tan^{-1}\text{Sin}\,\text{Cot}^{-1}x$.

Q.No.8A (2057)

Solve: $2\text{Sin}\,3x - 2\,\text{Sin}\,x + 5\,\text{Cos}\,2x = 0$

Q.No.2A (2057)

Prove that: $\text{Sin}(2\,\text{Sin}^{-1}x) = 2x\sqrt{1-x^2}$

Q.No.8A. Or (2056)

Solve: $\text{Sin}\,x + \sqrt{3}\cos x = \sqrt{2}$

Q.No.8A (2056)

Solve: $\text{Sin}^{-1}\frac{2a}{1+a^2} + \sin^{-1}\frac{2b}{1+b^2} = 2\text{Tan}^{-1}x$.

Q.No.2A (2056)

Find the value of $\tan^{-1}3 + \tan^{-1}\frac{1}{3}$.

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5 Sequence And Series, And Mathematical Induction

Q.No.12 (2070) 'D'

Sum to infinity the following series.

$1 - 5a + 9a^2 - 13a^2 + \ldots$ to ∞ $(-1 < a < 1)$

Q.No.2B (2070) 'D'

Using principle of mathematical induction,

Prove that : $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+ .... +\frac{1}{2^n} = 1 - \frac{1}{2^n}$

Q.No.12 (2070) 'C'

Show that the A.M., G.M. and H.M. between any two unequal positive numbers satisfy the following relations.

a) $(G.M)^2 = A.M \times H.M.$ b) A.M. > H.M.

Q.No.2B (2070) 'C'

Using principle of mathematical induction,

prove that: $1 + 3 + 5 = 7 + ... + (2n - 1) = n^2$.

Q.No.12 (2069) Supp.

The sum of an infinite number of terms in G.S. is 15, and the sum of their squares is 45; find the series.

Q.No.2B (2069) Supp.

Using principle of mathematical induction,

Prove that: $2 + 2^2 + 2^3 + ... + 2^n = 2(2^n - 1)$

Q.No.12 (2069) Set 'B'

Find the nth term and then the sum of the first n-terms of the series: $1^2.2 + 2^2.3 + 3^2.4.....$

Q.No.2B (2069) Set 'B'

Prove by the principle of mathematical induction.

$2 + 4 + 6 + ... + 2n = n(n+1).$

Q.No.12 (2069) Set 'A'

Find the sum of n terms of the series: $3.1^2 + 4.2^2 + 5.3^2 + ...$

Q.No.2B (2069) Set 'A'

Use the principle of mathematical induction:

$2 + 4 + 6 + ... + 2n = n(n+1).$

Q.No.12 (2069)

Prove that : $1^2+2^2+3^2+4^2+ .... +n^2 = \frac{n(n+1)(2n+1)}{6}$

Q.No.2B (2068)

Using the principle of mathematical induction,

Prove that : $1 + 2 + 3 + 4 + ... + n = 2\frac{n(n+1)}{2}$

□□□

6 Matrices And Determinants

Q.No.7B (2070) 'D'

Prove that: $\begin{vmatrix} a+x & b & c \\ a & b+y & c \\ a & b & c+z \end{vmatrix} = xyz\left(1+\frac{a}{x}+\frac{b}{y}+\frac{c}{z}\right)$

Q.No. 2C (2070) 'D'

If $A = \begin{pmatrix} 4 & -5 \\ 3 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ -1 & -2 \end{pmatrix}$ find B^TA^T.

Q.No.7B (2070) 'C'

Prove that: $\begin{vmatrix} a^2 & bc & c^2+ac \\ a^2+ab & b^2 & ac \\ ab & a^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$

Q.No.2c (2070) 'C'

If $A = \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$, Find AA^T.

Q.No.7b (2069) Supp.

Prove that : $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$

Q.No.2c (2069) Supp.

If $A = \begin{pmatrix} 5 & 3 \\ 4 & 2 \end{pmatrix}$, Find Adj. A.

Q.No.7b (2069) Set 'B'

Without expanding show that: $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix} = 0$

Q.No.2c (2069) Set 'B'

For the given matrices $A = \begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix}$, and $B = \begin{pmatrix} 5 & -2 \\ -2 & 1 \end{pmatrix}$, Show that : $(A+B) = A'+B'$.

Q.No.7b (2069) Set 'A'

Prove that : $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$

Q.No.2c (2069) Set 'A'

If $A = \begin{pmatrix} 4 & -5 \\ 3 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ -1 & -2 \end{pmatrix}$, Find $(AB)^T$

Q.No.7b (2068)

Show that: $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$

Q.No.2c (2068)

Find the inverse of the matrix $A = \begin{pmatrix} 7 & -3 \\ 6 & 2 \end{pmatrix}$.

Q.No.10a (2067) - 4 Marks

Prove that: $\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (b^2-ac)(ax^2+2bxy+cy^2)$

Q.No.3a (2067) - 2 Marks

Construct (3 x 3) matrix with the elements given by $a_{ij} = 2i + j$.

Q.No.10a (2066)

If a, b, c are non zero and $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$, then show that $abc = 1$

Q.No.3a (2066)

If $A + B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, and $A - 2B = \begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix}$, then determine the Matrix A.

Q.No.10A (2065)

Show that: $\begin{vmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{vmatrix} = 1 + x^2 + y^2 + z^2$

Q.No.3A (2065)

Define symmetric and skew symmetric matrix with examples.

Q.No.10A (2064)

Prove (without expanding):

$$\begin{vmatrix} 1 & bc & b+c \\ 1 & ca & c+a \\ 1 & ab & a+b \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$$

Q.No.4B (2064)

If $A = \begin{pmatrix} 3 & 2 \\ 2 & 1 \end{pmatrix}$, find A^{-1}

Q.No.10A (2063)

Prove (without expanding).

$$\begin{vmatrix} bc & a & a^2 \\ ca & b & b^2 \\ ab & c & c^2 \end{vmatrix} = \begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$$

Q.No.3A (2063)

Define a triangular matrix. How do you distinguish between upper and lower triangular matrixes?

Q.No.10A (2062)

Prove that: $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

Q.No.3A (2062)

If $A = \begin{pmatrix} 2 & 0 \\ 1 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} -2 & 1 \\ 3 & 2 \end{pmatrix}$ show that $(AB)^T = B^T A^T$

Q.No.10A (2061)

Without expanding show that:

$$\begin{vmatrix} 1 & bc & b+c \\ 1 & ca & c+a \\ 1 & ab & a+b \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$$

Q.No.3A (2061)

Construct a 3 x 3 matrix whose elements are $a_{ij} = 2i + j$.

Q.N 10A (2060)

Use properties of determinant to show that:

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$$

Q.N 3A (2060)

If $A = \begin{pmatrix} 2 & 0 \\ 1 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} -2 & 1 \\ 3 & 2 \end{pmatrix}$ show that $(AB)^T = B^T A^T$

Q.No.10A (2059)

Evaluate: $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$

Q.No.3A (2059)

Let A = $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 5 & 7 \\ 6 & 8 \end{pmatrix}$, Find $(AB)^T$.

Q.No.10A (2058)

If A = $\begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, Show that $A^2 - 2A - 5I = 0$

Q.No.3A (2058)

Let A = $\begin{pmatrix} 2 & 1 \\ 0 & 7 \end{pmatrix}$ and B = $\begin{pmatrix} 1 & 5 \\ 3 & 2 \end{pmatrix}$, Find (AB)

Q.No.10A (2057)

Find the value of: $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix}$

Q.N 3A (2057)

Let A = $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$, Find the transpose of AB.

Q.No.10A (2056)

Evaluate: $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix}$

Q.No.3 A (2056)

Let A = $\begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} 5 & 7 \\ 6 & 8 \end{pmatrix}$, Then prove AB ≠ BA.

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7 System of Linear Equations

Q.No.8A (2070) 'D'

Using row equivalent matrix or inverse matrix method, solve the following equations.

$9y - 5x = 3$, $x + z = 1$, $z + 2y = 2$

Q.No.3A (2070) 'D'

Applying Cramer's rule, solve the following equations:

$3x + \frac{4}{y} = 10$, $-2x + \frac{3}{y} = -1$.

Q.No.8A (2070) 'C'

Using row equivalent matrix method or inverse matrix method solve the following equations.

$x + 4y + z = 18$, $3x + 3y - 2z = 2$, $-4y + z = -7$

Q.No.3A (2070) 'C'

Using Cramer's rule, solve the following equations:

$3x - 2y = 8, \qquad 5x + 3y = 7$

Q.No.8A (2069) Supp.

Using row equivalent matrix method or inverse matrix method, solve the following system.

$3x + 5y = 2$
$2x - 3z = -7$
$4y + 2z = 2$

Q.No.3A (2069) Supp.

Using Cramer's rule, solve the following equations.

$2x - 5y = 24$
$2x + 3y = 12$

Q.No.8A (2069) Set 'B'

Using raw equivalent or inverse matrix method, solve the following system of equations.

$x - y = 0,\ 2x - y + 4z = 18,\ -3x + z + 2 = 0$

Q.No.3A (2069) Set 'B'

Solve by Cramer's rule: $3x + 2y + 9 = 0,\ 2x - 3y + 6 = 0$

Q.No.8A (2069) Set 'A'

Using row equivalent matrix method or inverse matrix method, solve the following equations.

$x - 2y - z = -7$
$2x + y + z = 0$
$3x - 5y + 8z = 13$

Q.No.3A (2069) Set 'A'

Using Cramer's rule, solve the following equations:

$x - 2y = -7$
$3x + 7y = 5$

Q.No.8A (2068)

Applying row equivalent matrix method or inverse matrix method, solve the following system of equations:

$x + y + z = 1$
$x + 2y + 3z = 4$
$x + 3y + 7z = 13$

Q.No.3A (2068)

Using Cramer's rule, solve the system of equations:

$2x + 5y = 17$
$5x - 2y = -1$

Q.No.10B (2067) -4 marks

Solve by Cramer's rule or Row-equivalent method

$x + y + z = 9, \qquad 2x + 5y + 7z = 52, \qquad 2x + y - z = 0.$

Q.No.3B (2067)- 2 Marks

Solve by matrix inversion method: $x + y = 3$ and $x - y = 1$.

Q.No.10B (2066)

Solve by row equivalent or inverse matrix method:

$x + z = 1,$
$z + 2y = 2,$
$5x - 9y = -3$

Q.No.3B (2066)

Solve by Cramer's rule: $\quad -x + y = 9, \qquad x - 3y = 5$

Q.No.10B (2065)

Solve by matrix method: $x + y + z = 6$
$x - y + z = 2$
$2x + y - z = 1$

Q.No.3B (2065)

Solve by Cramer's rule: $3x + 2y = 8,$
$4x + y = 9$

Q.No.10B (2064)

Solve the following system of equations by inverse matrix method or Cramer's rule:
$2x - y + 3z = 9, x + y + z = 6, x - y + z = 2.$

Q.No.3A (2064)

Solve by row-equivalent method: $3x - 2y = 8$
$5x + 3y = 7$

Q.No.10B (2063)

Solve by Cramer's rule or by row equivalent matrix method.
$x + y + z = 6$
$x - y + z = 2$
$2x + y - z = 1$

Q.No.4B (2063)

Solve by Inverse matrix method: $3x + 2y = 5$
$7x + 5y = 12$

Q.No.10B, Or (2062)

Solve the equations by Cramer's rule: $9y - 5x = 3$, $x + z = 1$ and $z + 2y = 2$

Q.No.10B (2062)

Solve by row- equivalent method: $9y - 5x = 3$, $x + z = 1$ and $z + 2y = 2$

Q.No.3B (2062)

Solve: $x = 2y + 3$ and $3x - 5y = 8$ by inverse matrix method.

Q.No.10B, Or (2061)

Solve by Row - equivalent matrix method:
$x - y - z = -2$, $x + 4z = 4$ and $y - 2z = 1$.

Q.No.10B (2061)

Solve by Cramer's rule: $x+2y+3z = 6$, $2x+4y+z = 7$ and $3x+2y+9z = 14$.

Q.No.3B (2061)

Solve by matrix inversion method, $x + y = 2$ and $x - y = 0$.

Q.No.10B, Or (2060)

Solve by matrix inversion method: $3x+5y = 7$, $5x+9y = 7$.

Q.No.10B (2060)

Solve, by row equivalent matrix method:
$x - 2y - 3z = -1$, $2x + y + z = 6$, $x + 3y - 2z = 13$.

Q.No.3B (2060)

Give reason why simultaneous equation $x + 2y = 5$ and $3x + 6y = 12$ are not solvable by Cramer's rule.

Q.No.10B ,Or (2059)

Solve by using inverse matrix method: $\left.\begin{array}{l} 2x + 4y = 7 \\ 8x - 6y = -5 \end{array}\right\}$

Q.No.10B (2059)

Solve by row equivalent matrix method: $x + z = 1$; $z + 2y = 2$; $5x - 9y = -3$.

Q.No.3b (2059)

Solve by Cramer's rule: $2x - y = 5$; $x - 2y = 1$.

Q.No.10b, Or (2058)

Solve by inverse matrix method: $2x + 5y = 7$, $5x + 2y = -3$

Q.No.10b (2058)

Solve, by row equivalent matrix method:

$$\begin{aligned} x + y + z &= 1 \\ x + 2y + 2z &= 4 \\ x + 3y + 7z &= 13 \end{aligned}$$

Q.No.3b (2058)

Solve by Cramer's rule:

$$\begin{aligned} x - 2y &= -7 \\ 3x + 7y &= 5 \end{aligned}$$

Q.No.10b, Or (2057)

Solve by inverse matrix method:

$$\begin{aligned} -2x + 4y &= 3 \\ 3x - 7y &= 1 \end{aligned}$$

Q.No.10b (2057)

Solve by using row equivalent matrix method:

$x - 2y + 2z = 0$; $x - 2y + 3z = -1$; $2x - 2y + z = -3$

Q.No.3b (2057)

Solve by Cramer's rule: $2x - y = 5$; $x - 2y = 1$.

Q.No.10b, Or (2056)

Solve by using inverse matrix method: $x - y = 2$; $2x + 3y = 9$

Q.No.10b (2056)

Solve by row equivalent matrix method: $x + z = 1$; $z + 2y = 2$; $5x - 9y = -3$

Q.No.3b (2056)

Solve by Cramer's rule: $-x + y = 9$, $x - 3y = 5$

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8 | Complex Number

Q.No.14, Or (2070) 'D'

Find the cube roots of unity. Also, establish the properties of cube roots of unity.

Q.No.14 (2070) 'D'

Define absolute value of a complex number. If z and W are two complex numbers, prove that : $|z + w| \leq |z| + |w|$

Q.No.3b (2070) 'D'

Find the values of x and y if $(x + 2) + yi = (3 + i)(1 - 2i)$.

Q.No.17 (2070) 'C'

Finds the square root of the complex number $-5 + 12i$.

Q.No.3b (2070) 'C'

If $\alpha = \frac{1}{2}(-1+\sqrt{-3})$, $\beta = \frac{1}{2}(-1-\sqrt{-3})$, Show that : $\alpha^4 + \alpha^2\beta^2 + \beta^4 = 0$.

Q.No.14 (2069) Supp.

State De' Moiver's theorem and use it to solve the equation $z^6 = 1$.