# MATHS

# BOOKS - MBD MATHS (ODIA ENGLISH)

# RELATION AND FUNCTION

## Question Bank

**1.** If A-{a,b,c,d) mention the type of relations on A given below, which of them are equivalence relations?

{(a, a),(b,b)}

**2.** If A-{a,b,c,d) mention the type of relations on A given below, which of them are equivalence relations?

{(a, a),(b,b), (c,c), (d, d)}

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**3.** If A={a,b,c,d} mention the type of relations on A given below, which of them are equivalence relations? $\{(a, b), (b, a), (b, d), (d. b)\}$

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**4.** If A={a,b,c,d} mention the type of relations on A given below, which of them are equivalence relations? $\{(b, c), (b, d), (c, d)\}$

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**5.** If A={a,b,c,d} mention the type of relations on A given below, which of them are equivalence relations? $\{(a,a),b,b),(c,c),(d,d),(a,d),(a,c),(d,a),(c,a),(c,d),(d,c)\}$

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**6.** Write relations in tabular form and determine their type for $R=\{(x,y):2x-y=0\}onA=\{1,2,3,\ldots,13\}$

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**7.** Write relations in tabular form and determine their type for $R=\{(x,y):x\text{divides}y\}onA=\{1,2,3,4,5,6\}$

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**8.** Write relations in tabular form and determine their type for

$R = \{(x, y) : x \text{divides} 2 - y\} \text{on} A = \{1, 2, 3, 4, 5\}$

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**9.** Write the relations in tabular form and determine their type.

R= {(x, y): y $\leq$ x $\leq$ 4} on A = {1,2,3,4,5)

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**10.** Test whether the relations are reflexive, symmetric or transitive on the sets specified.

R={(m,n):m-n $\geq$ 7) on Z.

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**11.** Test wheter relations are reflexive, symmetric or transitive on the sets specified for $R = \{(m, n\} : 2 \mid (m+n)\} \text{on} Z.$

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**12.** Test whether the relations are reflexive, symmetric or transitive on the sets specified.

R= {(m,n): m +n is not divisible by 3) on Z.

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**13.** Test whether the relations are reflexive, symmetric or transitive on the sets specified.

R={(m,n): $\frac{m}{n}$ is a power of 5} on Z - {0}.

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**14.** Test whether the relations are reflexive, symmetric or transitive on the sets specified.

R=(m,n}: mn is divisible by 2) on Z.

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**15.** Test wheter relations are reflexive, symmetric or transitive on the sets specified for $R = \{(m, n) : 3\text{divides}m - n\}on\{1, 2, 3. \dots, 10\}$.

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**16.** List the members of the equivalence relation defined by $\{\{1\}, \{2\}, \{3, 4\}\}$ partitins on X={1,2,3,4}.Also find the equivalence classes of 1,2,3 and 4.

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**17.** List the members of the equivalence relation defined by $\{\{1, 2, 3\}, \{4\}\}$ partitins on X={1,2,3,4}.Also find the equivalence classes of 1,2,3 and 4.

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**18.** List the members of the equivalence relation defined by $\{\{1, 2, 3, 4\}\}$ partitins on X={1,2,3,4}.Also find the equivalence classes of 1,2,3 and 4.

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**19.** Show that if R is an equivalence relation on X then dom R=rngR =X.

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**20.** Given an example of a relation which is

reflexive, symmetric but not transitive.

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**21.** Given an example of a relation which is

reflexive, transitive but not symmetric.

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**22.** Given an example of a relation which is

symmetric, transitive but not reflexive.

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**23.** Given an example of a relation which is

reflexive but neither symmetric nor transitive.

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**24.** Given an example of a relation which is

transitive but neither reflexive nor symmetric.

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**25.** Given an example of a relation which is

an empty relation.

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**26.** Given an example of a relation which is

a universal relation.

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**27.** Let R be a relation on X, If R is symmetric then $xRy \Rightarrow yRx$. If it is also transitive then xRy and $yRx \Rightarrow xRx$.So whenver a relation is symmetric and transitive then it is also reflexive. What is wrong in this argument ?

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**28.** Suppose a box contains a set of n balls $(n > 4)$(denoted by B )of four different colours (many have different sizes), viz,red, blue, green and yellow. Show that a relation R defined on B as $R = \{(b_1, b_2) : \text{balls} b_1 \text{and} b_2$ have the same colour} is an equivalence relation on B. How many equivalence classes can you find with respect ot R ?

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**29.** Find the number of equivalence, relations on X ={1,2,3),

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**30.** Let R be the relation on the set R of real numbers such that aRb iff a-b is and integer. Test whether R is an equivalence relation. If so find the equivalence class of $1 \text{and} \frac{1}{2}$ wrt. This equivalence relation.

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**31.** Find the least positive integer r such that $185 \in [r]_7$

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**32.** Find the least positive integer r such that $-375 \in [r]_{11}$

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**33.** Find the least positive integer r such that $-12 \in [r]_{13}$

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**34.** Find least non negative integer r such that $7 \times 13 \times 23 \times 413 \equiv r \pmod{11}$

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**35.** Find least non negative integer r such that

$6 \times 18 \times 27 \times (-225) \equiv r(\text{mod } 8)$

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**36.** Find least non negative integer r such that

$1237(\text{mod } 4) + 985(\text{mod } 4) \equiv r(\text{mod } 4)$

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**37.** Find least non negative integer r such that

$1936 \times 8789 \equiv r(\text{mod}4)$

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**38.** Find least positive integer x, satisfying

$276x + 128 = 4$ (mod 7).

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**39.** Find three positive integers

$x_i, i = 1, 1, 3 \text{satisfying} 3x \equiv 2(\text{mod } 7)$

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**40.** Let X ={x,y} and Y ={u,v}. Write down all the functions that can be defined from X To Y. How many of these are (i) one-one (ii) onto and (iii)one-one and onto ?

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**41.** Let X and Y be sets containing m and n elements respectively.What is the total number of functions from X to Y.

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**42.** Let X and Y be sets containing m and n elements respectively.How many functions from X to Y are one-one according as $m < n, m > n \text{and} m = n$?

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**43.** Examine $f: R \rightarrow R, f(x) = x^2$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**44.** Examine $f: R \to [-1, 1], f(x) = \sin x$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**45.** Examine $f: R_+ \to R+, f(x) = x + \frac{1}{x}$ where$R_+ = \{x \in R: x > 0\}$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**46.** Examine$f: R \to R, f(x) = x^3 + 1$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**47.** Examine $f:(-1,1) \to R,\ f(x) = \dfrac{x}{1-x^2}$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**48.** Examine $f: R \to R,\ f(x) = [x] = \text{the greatest integer} \le x.$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**49.** Examine $f: R \to R,\ f(x) = |x|$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**50.** Examine $f: R \rightarrow R,\ f(x) = \text{sgn} x$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**51.** Examine $f: R \rightarrow R, f = id_R = \text{the identity function or R.}$ functions if it is (i) injective (ii) surjective, (iii) bijective and (iv) none of the three.

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**52.** Show that f(x)=sin x on [0, pi/2] functions are injective.

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**53.** Show that $f(x) = \cos x[0, \pi]$ functions are injective.

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**54.** Show that $f(x) = \log_a x \text{on}(0, \infty), (a > 0 \text{and} a \neq 1)$ functions are injective.

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**55.** Show that $f(x) = a^x \text{on} R. (a > 0 \text{and} a \neq 1)$ functions are injective.

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**56.** Show that functions f and g defined by f(x)=2 log x and g(x) $= \log x^2$ are not equal even though log `x^2 =2 log x.

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**57.** Give an example of a function which is Surjective but not injective.

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**58.** Give an example of a function which is injective but not surjective.

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59. Give an example of a function which is neither injective nor surjective.

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60. Give an example of a function which is bijective

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61. Prove that $\{1, 2, 3, 4, 5, 6, \ldots\ldots\}$ set are equivalent.

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62. Prove that the following sets are equivalent

{1, 2, 3, 4, 5, 6.....}, (2, 4, 6, 8, 10,...)

(1,3,5, 7, 9,...), {1, 4, 9, 16, 25...)

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**63.** Prove that the following sets are equivalent

{1, 2, 3, 4, 5, 6.....}, (2, 4, 6, 8, 10,...)

(1,3,5, 7, 9,...), {1, 4, 9, 16, 25...)

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**64.** Prove that the following sets are equivalent

{1, 2, 3, 4, 5, 6.....}, (2, 4, 6, 8, 10,...)

(1,3,5, 7, 9,...), {1, 4, 9, 16, 25...)

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**65.** Let f={(1,a),(2,b),(3,c),(4,d)} and g={(a,x),(b,x),(c,y),(d,x)} Determine gof and fog if possible. Test whether fog=gof.

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**66.** Let f= {(1,3),(2,4),(3,7)} and g ={(3,2),(4,3),(7,1)}

Determine gof and fog if possible . Test whether fog =gof.

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**67.** $\text{Let} f(x) = \sqrt{x} \text{and} g(x) = 1 - x^2$. Find natural domains of f and g.

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68. Let $f(x) = \sqrt{x}$ and $g(x) = 1 - x^2$. Compute fog and gof and find their natural domains.

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69. Let $f(x) = \sqrt{x}$ and $g(x) = 1 - x^2$. Find natural domain of h(x) = 1-x.

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70. Let f(x) = $\sqrt{x}$ and g(x) = $1 - x^2$.

Show that hgof only on $R_0 = \{x \in R : x \geq 0\}$ and not on R..

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**71.** Find the composition fog and gof and test whether fog = gof when f and g are functions or R given by $f(x) = x^3 + 1, g(x) = x^2 - 2$

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**72.** Find the composition fog and gof and test whether fog = gof when f and g are functions or R given by $f(x) = \sin x, g(x), g(x) = x^5$

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**73.** Find the composition fog and gof and test whether fog = gof when f and g are functions or R given by $f(x) = \cos x, g(x) = \sin x^2$

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**74.** Find the composition fog and gof and test whether fog = gof when f and g are functions or R given by $f(x) = g(x) = (1 - x^3)^{\frac{1}{3}}$

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**75.** Let f be a real function. Show that h(x) =f(x)=f(-x) is always an even function and g(x) = f(x) -f(-x) is always an odd fuction.

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**76.** Express each of $1 + x + x^2$ function as the sum of an even function and an odd function.

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77. Express each of $x^2$ function as the sum of an even function and an odd function.

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78. Express each of $e^x$ function as the sum of an even function and an odd function.

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79. Express each of $e^x + \sin x$ function as the sum of an even function and an odd function.

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**80.** Let $X = \{1, 2, 3, 4\}$Determine whether f:$X \rightarrow X$defined as given below have inverses. Find $f^{-1}$ if it exist

$f = \{(1, 4, ), (2, 3), (3, 2), (4, 1)\}$

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**81.** Let $X = \{1, 2, 3, 4\}$Determine whether f:$X \rightarrow X$defined as given below have inverses. Find $f^{-1}$ if it exist

$f = \{(1, 3)(2, 1), (3, 1), (4, 2)\}$

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**82.** Let $X = \{1, 2, 3, 4\}$Determine whether f:$X \rightarrow X$defined as given below have inverses. Find $f^{-1}$ if it exist

$f = \{(1, 2), (2, 3), (3, 4), (4, 1)\}$

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83. Let X $= \{1, 2, 3, 4\}$Determine whether f:$X \rightarrow X$defined as given below have inverses. Find $f^{-1}$ if it exist $f = \{(1, 1), (2, 2), (2, 3), (4, 4)\}$

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84. Let X ={1,2,3,4}Determine whether f:$X \rightarrow X$defined as given below have inverses. Find $f^{-1}$ if it exist $f = \{(1, 2), (2, 2), (3, 2), (4, 2)\}$

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85. Construct an example to show that $f(A \cap B) \neq f(A) \cap f(B)$ where $A \cap B \neq \theta$.

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**86.** Prove that for any $f: X \to Y$, $foid_x = f = id_Y$ of.

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**87.** Prove that $f: X \to$ Y is surjective iff for all $B \subseteq Y, f\left(f^{-1}(B)\right) = B$.

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**88.** Prove that $f: X \to Y$ is injective iff $f^{-1}(f(A)) = \text{A for all} A \subseteq X$.

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**89.** Prove that $f : X \to Y$ is injective iff for all $\subset s A, B of X, f(A \cap B) = f(A) \cap f(B)$.

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**90.** Prove that f:$X \to Y$ is surjective iff for all $A \subseteq X, (f(A))' \subseteq f(A')$, where A' denotes the complement of A in X.

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**91.** Show that the operation * given by x*y=x+y+ -xy is a binary oeration on Z,Q and R but not on N.

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**92.** Determine whether$a * b = 2a + 3b \text{on} Z$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**93.** Determine whether $a * b = ma - nb \text{on} Q + \text{where} m \text{and} n \in N$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**94.** Determine whether $a * b = a + b (\text{mod} 7) \text{on} \{0, 1, 2, 3, 4, 5, 6\}$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**95.** Determine whether $a * b = \min\{a, b\} \text{on} N$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**96.** Determine whether $a * b = \text{GCD}\{a, b\} \text{on} N$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**97.** Determine whether $a * b = \text{LCM}\{a, b\} \text{on} N$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**98.** Determine whether $a * b = \text{LCM}\{a, b\}\text{on}\{0, 1, 2, 3, 4. \dots, 10\}$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**99.** Determine whether $a * b = \sqrt{a^2 + b^2} on Q_+$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**100.** Determine whether $a * b = a \times b(\text{mod}5)\text{on}\{0, 1, 2, 3, 4\}$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**101.** Determine whether $a * b = a^2 + b^2 \text{on} N$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**102.** Determine whether $a * b = a + b - ab \text{on} R - \{1\}$ operations as defined by * are binary operations on the sets specified in each case. Give reasons if it is not a binary operation.

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**103.** Constract the composition table/multiplication table for the binary operation * defined on {0,1,2,3,4}by $a * b = a \times b(\text{mod} = 5)$. Find the identity element if any. Also find the inverse elements of 2 and 4.