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MATHS

BOOKS - MODERN PUBLICATION

RELATION AND FUNCTIONS

Exercise

1. Write the smallest equivalence relation on A = {1,2,3}.

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2. Congruence modulo 3 relation partitions the set Z into how many equivalence classes ?

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3. Given an example of a relation which is reflexive, symmetric but not transitive.

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4. Given an example of a relation which is reflexive, transitive but not symmetric.

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5. Given an example of a relation which is reflexive but neither symmetric nor transitive.

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

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7. Find three positive integers $x_i, i = I, 2, 3$ satisfying $3x = 2 (\mod 7)$.

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8. State the reason for the relation R in the set {1, 2, 3} given by R ={(1, 2), (2, 1)} not to be transitive.

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9. Show that $f : R \rightarrow R$ defined as $f(x) = sgn(x)$ is neither one-one nor onto.

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

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11. 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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12. Express each of the following function as the sum of an even function and an odd function: $1 + X + X^2$.

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13. 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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14. If the invertible function f is defined as

$f(X) = \frac{3x-4}{5}$, write $f^{-1}(X)$.

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15. Let $f, R \rightarrow R$ and $g, R \rightarrow R$ defined as

$f(x) = |x|, g(x) = |5x - 2|$ then find fog.

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16. Let $\cdot$ is a binary operation defined by $a \cdot b = 3a + 4b - 2$, find $4 \cdot 5$.

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17. Let the binary operation on Q defined as $a \cdot b = 2a + b - ab$, find $3 \cdot 4$.

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18. Let $\cdot$ is a binary operation on Z defined as $a \cdot b = a + b - 5$ find the identity element for $\cdot$ on z.

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19. Find the number of binary operations on the set {a, b}.

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20. Let $\cdot$ is a binary operation on $[0, ¥)$ defined as $a \cdot b = \sqrt{a^2 + b^2}$ find the identity element.

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21. 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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22. Find least non negative integer r such that

$$7 \times 13 \times 23 \times 413 \equiv r \pmod{11}$$

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23. Find least non negative integer r such that

$$1237 \pmod{4} + 985 \pmod{4} \equiv r \pmod{4}$$

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24. For real numbers x and y, define x R y if and only if $x - y + \sqrt{2}$ is an irrational number. Is R transitive? Explain your answer.

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25. Let A = {a,b,c) and the relation R be defined on A as follows:

R={{a,a), (b,c),(a,b)}.

Then, write minimum number of ordered pairs to be added in R to make R reflexive and transitive.

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26. 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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27. Show that the relation R in the set of real numbers, defined as $R = \{(a, b) : a \leq b^2\}$ is neither reflexive nor symmetric nor transitive.

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

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29. 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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30. Let * is a binary operation on the set of all non-zero real numbers, given by $a * b = \frac{ab}{5}$ for all $c, b \in R - (0)$. Find the value of x, given that $2 * (x * 5) = 10$.

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31. 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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32. 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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33. If f:X $\rightarrow$ Y and g:Y $\rightarrow$ Z be two bijective functions, then prove that $(gof)^{-1}$ =f^(-1)og(-1)`.

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

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35. Prove that f:$X \rightarrow Y$ 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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36. Let A and B be sets.

Show that f : $A \times B \to B \times A$ such that f (a,b) = (b,a) is bijective function .

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

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38. Consider f:$R_+ \ [4, \infty]$ is given by f(x)= $x^2 + 4$. Show that f is invertible with the inverses f^{-1} of f given by $f^{-1}(y) = \sqrt{y-4}$, where R_+, is the set of all non-negative real numbers.

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

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41. Let A = {1, 2, 3). Then, show that the number of relations containing (1, 2) and (2, 3) which are reflexive and transitive but not symmetric is three.

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42. Let R be a relation on the set A of ordered pairs of positive integers defined by (x, y) R (u, v), if and only if xv = yu. Show that R is an equivalence relation.

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43. Show that $f : N \to N$, given by

$$f(x) = \begin{cases} x + 1, \text{ if x is odd} \\ x - 1, \text{ if x is even} \end{cases}$$

is bijective (both one-one and onto).

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44. Prove that $f: X \to Y$ is injective iff for all subsets A, B of X, $f(A \cap B) = f(A) \cap f(B)$.

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45. Congruence modulo 3 relation partitions the set Z into how many equivalence classes ?

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46. 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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47. Constract the composition table/multiplication table for the binary operation * defined on {0,1,2,3,4}by

$a * b = a \times b(\mathrm{mod} = 5)$. Find the identity element if any. Also find the inverse elements of 2 and 4.

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