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MATHS

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RELATIONS AND FUNCTIONS

Example

1. Let T be the set of all triangles in a plane with R a relation in T given by

$\{(T_1, T_2) : T_1 \cong T_2\}$show that R is an equivalence relation.

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2. * be a binary operation on Q,defined as $a * b = \frac{3ab}{5}$ .Show that *is commutative.

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3. *be a binary operation on Q,defined as $a * b = \frac{3ab}{5}$ .Show that * is associative.

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4. *be a binary operation on Q,defined as $a * b = \frac{3ab}{5}$ Find the identity element of *if any.

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5. Consider the following functions.$f: Z \to Z$ defined by $f(x) = 3x + 7$ and $g: R \to R$ defind by $g(x) = 2x - 3$. Of

the above two functions

one is a bijective function and the other is not.Give reason.

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6. Which of the relations R on the set of the real numbers is an equivalence relation?

$(a).\ xRy$ if $|x| = |y|$

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7. Which of the relations R on the set of the real numbers is an equivalence relation?

$(b) xRy$ if $x - y \geq 0$

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8. In the set of all natural numbers,let a relation defined by $\{(a, b) : a, b \in N, a - b$ is divisible by $5\}$.Prove that R is an equivalence relation.

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9. If $f: R \to R$ is given by $f(x) = 3x - 1$, $g: R \to R$ is given by $g(x) = 2x$,show that $fog - gof = 1$.

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10. Find the domain,range and inverse of $f: x \to \frac{x-3}{2x+1}$.

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11. Prove that the function $f: N \to N$, defined by

$f(x) = x^2 + x + 1$ is one-one but not onto.

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12. Consider the binary operation * on the set {1,2,3,4,5} given by the following table(i)Is *

commutative?.

*	1	2	3	4	5
1	1	1	1	1	1
2	1	2	1	2	1
3	1	1	3	1	1
4	1	2	1	4	1
5	1	1	1	1	5

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13. Consider the binary operation * on the set {1,2,3,4,5} given by the following table.

(ii)Compute (2*3)*4 and2*(3*4).

*	1	2	3	4	5
1	1	1	1	1	1
2	1	2	1	2	1
3	1	1	3	1	1
4	1	2	1	4	1
5	1	1	1	1	5

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14. Consider the binary operation * on the set {1,2,3,4,5} given by the following table.iii)

Compute (2*3)*(4*5).

*	1	2	3	4	5
1	1	1	1	1	1
2	1	2	1	2	1
3	1	1	3	1	1
4	1	2	1	4	1
5	1	1	1	1	5

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15. Let * be a binary operation on N,defined bya*b=a^b, $a, b \in N$.is * associative or commutative?

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16. If the following $f: R \to R$is given by $f(x) = \frac{x+3}{3}$ and$g: R \to R$ is given by g(x)=2x-3.Find fog

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17. If the following $f: R \to R$is given by $f(x) = \frac{x+3}{3}$ and$g: R \to R$ is given by $g(x) = 2x - 3$.Find gof

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18. If the following $f: R \to R$is given by $f(x) = \frac{x+3}{3}$ and$g: R \to R$ is given by $g(x) = 2x - 3$.Is $f^{-1} = g$

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19. Consider $f: R_+ \to [-5, \infty)$given by $f(x) = 9x^2 + 6x - 5$.Show that f is invertible with $f^{-1}(y) = \left(\frac{\sqrt{y+6}-1}{3}\right)$

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20. A is a non empty set and let*be a binary operation an P(A)the prower set of A defined by $X * Y = X \cap Y$ for X,$Y \in P(A)$(i) Show that A*B=B* A for A,$B \in P(A)$

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21. A is a non empty set and let*be a binary operation an P(A)the prower set of A defined by $X * Y = X \cap Y$ for X,$Y \in P(A)$(ii)Show that * is associative.

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22. Let S be the set of all sets and let $R = \{(A, B) : A \subset B\}$ i.e A is a proper subset of B.Show that R is (i).Transitive

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23. Let S be the set of all sets and let $R = \{(A, B) : A \subset B\}$ i.e A is a proper subset of B.Show that R is Not reflexive

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24. Let S be the set of all sets and let $R = \{(A, B) : A \subset B\}$ i.e A is a proper subset of B.Show that R is not symmetric

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25. Prove that the function $f : N \to N$ f(x)=3x,is one -one and into.

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26. If f:$R \to R$ be defined by $f(x) = 2x - 3$ and $g: R \to R$ be defined by $g(x) = \frac{x+3}{2}$ .Show that $fog = I_R = gof$

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27. If f:$R \to R$ be defined by f(x)=3x+2.Show that f is invertible.Find $f^{-1}: R \to R$.Hence find $f^{-1}(3)$and $f^{-1}(0)$

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28. Consider the binary operation $* : Q \to Q$,where Q is the set of rational numbers,is defined as a*b=a+b-ab.(i).Is * associative?Justify your answer.

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29. Consider the binary operation $* : Q \to Q$ where Q is the set of rational numbers as defined as $a * b = a + b - ab$

Is identity for $*$ exist? If yes, find the identity element.

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30. Consider the binary operation $* : Q \to Q$ where Q is the set of rational numbers as defined as $a * b = a + b - ab$

Are elements of Q invertible? Is yes, find the inverse of an element in Q

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31. A fuction $f: R \to R$ defined by $f(x) = \frac{2x - 3}{7}$ .Is f a one-one function?Why?

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32. A fuction $f: R \to R$ defined by $f(x) = \frac{2x - 3}{7}$ ii.Prove that f is invertible.

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33. A fuction $f: R \to R$ defined by $f(x) = \frac{2x - 3}{7}$.

Find f^{-1}

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34. Show that the relation 'S' in set $A = \{x \in z: 0 \leq x \leq 12\}$ given by S= {(a,b):a.bin z,|a-b|`is divisble by a} is an equivalence relation.

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35. Let $f: \{1, 2, 3\} \to \{3, 5, 7\}$ and $g: \{3, 5, 7\} \to \{7, 23, 47\}$given by f(1)=3,f(2)=5,f(3)=,g(3)=7,g(5)=23,g(7)=47 (i).Find gof

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36. Let Q be the set of Rational numbers and ' $*$ ' be the binary operation on Q defined by ' $a * b = \frac{ab}{4}$' for all a,b in Q.

Find the inverse element of ' $*$ ' on Q.

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37. Let Q be the set of Rational numbers and ' $*$ ' be the binary operation on Q defined by ' $a * b = \frac{ab}{4}$ ' for all a,b in Q.

Find the inverse element of ' $*$ ' on Q.

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38. Show that the function $f: R \to R$ defined by $f(x) = 2x - 3$ is one-one and onto. Find

f^{-1}

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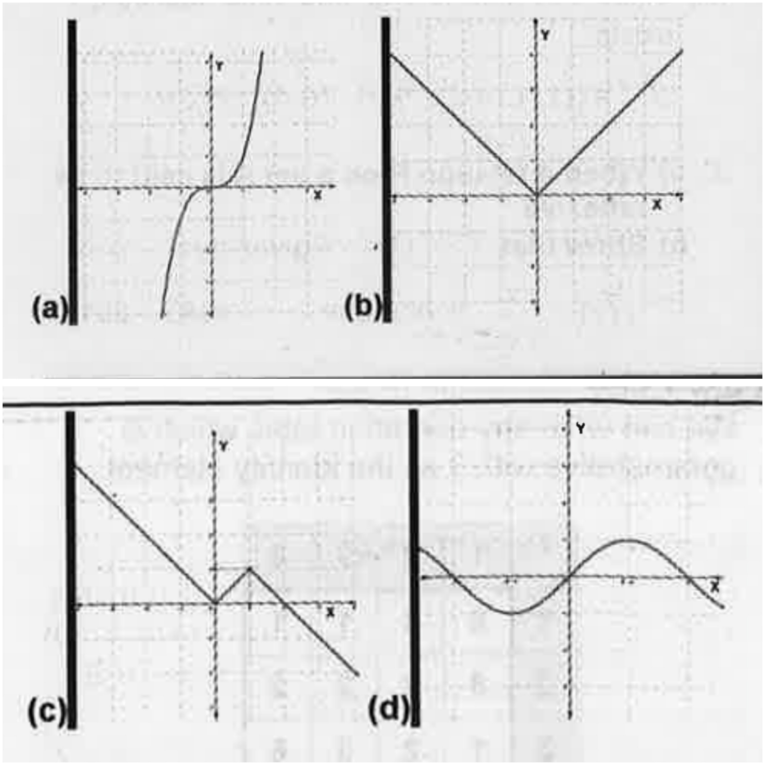
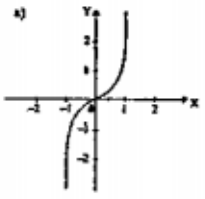
39. Which of the following figure represents the graph of a function on R which is onto but

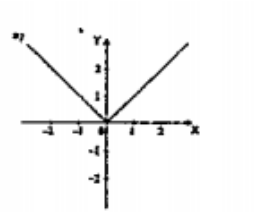
not one-one.



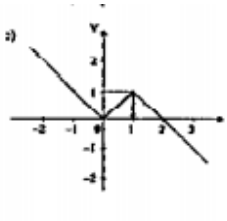
A.



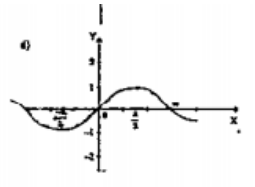
B.



C.



D.



Answer:

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40. $A = \{1, 2, 3, 4, 6\}$, $*$ is a binary operation on A is defined as $a * b = HCF$ of a and b.

Represent $*$ with the help of an operation table.

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41. $A = \{1, 2, 3, 4, 6\}$, $*$ is a binary operation on A is defined as $a * b = HCF$ of a and b.

Find the identity element.

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42. $A = \{1, 2, 3, 4, 6\}$, $*$ is a binary operation on A is defined as $a * b = HCF$ of a and b. Draw its operation table.

Write a commutative binary operation on A with 3 as the identity element. (Hint: Operation table may be used.

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43. Give an example of a relation which is reflexive but not symmetric

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44. Give an example of a relation which is transitive but not symmetric

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45. Let A={3,5} and B={7,11}.Let $R = \{(a, b) : a \in A, b \in B, a - b$ is odd}.Show that R is an empty relation from A into B.

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46. Let * be a binary operation on setQ of rational numbers such that $a * b = (2a - b)^2 : a, b \in Q$ i.Find 3*5

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47. If $f: R \rightarrow R$ be given by f(x) = $\left(3 - x^3\right)^{\frac{1}{3}}$, then (f o f) (x) is

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48. Let * be the binary operation on N given by x*y=LCM of x,y.Find 9*5?

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49. Let $A = N \times N$ and $'*'$ be the binary operation. On A defined by $(a, b) * (c, d) = (a + c, b + d)$. Show that $'*'$ is commutative and associative. Find the identity for $'*'$ on A if any.

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

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51. Show that the function f in $A = R - \left\{\frac{2}{3}\right\}$ defined as $f(x) = \frac{4x+3}{6x-4}$ is one-one and onto.Hence find f^{-1}

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52. If R_1 and R_2 are equivalence relations in a set A, show that $R_1 \cap R_2$ is also an equivalence relation.

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53. Consider the set $A = \{1, 2, 3, 4, 5\}$, and $B = \{1, 4, 9, 16, 25\}$ and a function $f: A \to B$ defined by $f(1) = 1$, $f(2) = 4$, $f(3) = 9$, $f(4) = 16$ and $f(5) = 25$.

Show that f is one-to-one.

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54. Consider the set $A = \{1, 2, 3, 4, 5\}$, and $B = \{1, 4, 9, 16, 25\}$ and a function

$f: A \to B$ defined by $f(1) = 1$, $f(2) = 4$, $f(3) = 9, f(4) = 16$ and $f(5) = 25$.

Show that f is onto.

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55. Consider the set $A = \{1, 2, 3, 4, 5\}$, and $B = \{1, 4, 9, 16, 25\}$ and a function $f: A \to B$ defined by $f(1) = 1$, $f(2) = 4$, $f(3) = 9, f(4) = 16$ and $f(5) = 25$.

Does f^{-1} exists? Explain.

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56. Let $f: R \to R$ be given by $f(x) = \frac{2x+1}{3}$

find

fof and show that f is invertible.

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57. Let R be a Relation in the set

$A = \{1, 2, 3, 4, 5, 6\}$ define as

$R = \{(x, y): y = 2x - 1\}$

Write R in roster form and find it's domain and

range

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58. Let R be a Relation in the set

$A = \{1, 2, 3, 4, 5, 6\}$ define as

$R = \{(x, y) : y = 2x - 1\}$

Is R an equivalance relation? Justify.

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59. The relation R defined on the A={-1,0,1} as

$R = \{(a, b) : a^2 = b\}$

Check whether R is reflexive,symmetric and transitive

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60. The relation R defined on the A={-1,0,1} as

$R = \{(a, b) : a^2 = b\}$

Check whether R is reflexive,symmetric and transitive

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61. Let $A = \{1, 2, 3\}$. Give an example of a relation on A which is

Symmetric but neither reflexive nor transitive.

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62. Let $A = \{1, 2, 3\}$. Give an example of a relation on A which is

Transitive but neither reflexive nor symmetric.

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63. Let be a function defined by $f(x) = \sqrt{x}$ is a function if it defined from f : N $\rightarrow$ N`

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64. Check the injectivity and surjectivity of the following functions

$f: N \rightarrow N$ defined by $f(x) = x^3$

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65. Check the injectivity and surjectivity of the following functions

$f: R \to R$ given by $f(x) = [x]$

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66. Find fog and gof if $f(x) = |x|$ and $g(x) = |3x + 4|$

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67. Find fog and gof if $f(x) = 16x^4$ and $g(x) = x^{\frac{3}{4}}$

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68. If $f(x) = \dfrac{4x+3}{6x-4}, x \neq \dfrac{2}{3}.$

Show that $fof(x) = x$, for all $x \neq \dfrac{2}{3}.$

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69. Let S={(1,2),(2,3),(3,4)}.Find the domain and range of S.

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70. Let S={(1,2),(2,3),(3,4)}. Find S^{-1}

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71. Let S={(1,2),(2,3),(3,4)}. Find the domain and range os S^{-1}

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72. Consider $f: \{3, 4, 5, 6\} \to \{8, 10, 12, 13, 14\}$ and $f = \{(3, 8), (4, 10), (5, 12), (6, 14)\}$. State whether f has inverse? Give reason.

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73. Consider $f: R \to R$ given by $f(x) = 3x + 2$ show that f is invertible. Find

the inverse of f

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74. Choose the correct answer from the bracket.If $x \neq 1$and $f(x) = \frac{x+1}{x-1}$ is a real function,then fof(2)=_____(1,2,3,4) and What is the inverse of f.

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75. Choose the correct answer from the bracket.If $x \neq 1$and $f(x) = \frac{x+1}{x-1}$ is a real function,then fof(2)=_____(1,2,3,4).Find $f(3) + f^{-1}(3)$

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76. Determine whether the following is a binary operation or not?Justify $a * b = 2^{ab}$ defined on Z

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77. Determine whether * is commutative or associative if $a * b = \frac{ab}{6}, a, b \notin R$

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78. Consider the binary operation $* : Q \to Q$ where Q is the set of rational numbers as defined as $a * b = a + b - ab$

Find $2 * 3$

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79. Consider the binary operation $* : Q \to Q$ where Q is the set of rational numbers as defined as $a * b = a + b - ab$

Is identity for $*$ exist? If yes, find the identity element.

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80. Consider the binary operation $* : Q \to Q$ where Q is the set of rational numbers as defined as $a * b = a + b - ab$

Are elements of Q invertible? Is yes, find the inverse of an element in Q

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81. 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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82. Show that the function f in $A = R - \left\{\frac{2}{3}\right\}$ defined as $f(x) = \frac{4x+3}{6x-4}$ is one-one and onto.Hence find f^{-1}

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83. Let R be a.relation from Q to Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a - b \in Z\}$. Show that

i) $(a, a) \in R$ for all $a \in Q$

ii) $(a, b) \in R$ implies that $(b, a) \in R$

iii) $(a, b) \in R$ and $(b, c) \in R$ implies that $(a, c) \in R$.

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84. Let R be a.relation from Q to Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a - b \in Z\}$. Show that

i) $(a, a) \in R$ for all $a \in Q$

ii) $(a, b) \in R$ implies that $(b, a) \in R$

iii) $(a, b) \in R$ and $(b, c) \in R$ implies that $(a, c) \in R$.

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85. Let R be a.relation from Q to Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a - b \in Z\}$. Show that

i) $(a, a) \in R$ for all $a \in Q$

ii) $(a, b) \in R$ implies that $(b, a) \in R$

iii) $(a, b) \in R$ and $(b, c) \in R$ implies that $(a, c) \in R$.

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86. In each of the following cases, states whether the function is one-one, onto or bijective. Justify your answer. $f: R \to R$ defined by f(x) =3 - 4x

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87. In each of the following cases, states whether the function is one-one, onto or bijective. Justify your answer. $f: R \to R$ defined by f(x) = $1 + x^2$

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88. In each of the following cases,state whether the function is onto,one to one or bijective.Justify your answer if $: N \to N$ defined by

$$f(n) = \begin{cases} \frac{n+1}{2} & nisodd \\ \frac{n}{2} & niseven \end{cases}$$

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89. In each of the following cases,state whether the function is onto,one to one or

bijective.Justify your answer 'if:NrarrN defined by

f(n)={((n+1)/2,n is odd),(n/2,n is even):}`


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90. In each of the following cases,state whether the function is onto,one to one or bijective.Justify your answer 'if:NrarrN defined by

f(n)={((n+1)/2,n is odd),(n/2,n is even):}`


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91. In each of the following cases,state whether the function is onto,one to one or bijective.Justify your answer 'if:NrarrN defined by

f(n)={((n+1)/2,n is odd),(n/2,n is even):}`

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92. Prove that the greatest integer function $f: R \to R$ given by $f(x) = [x]$ is neither one-

one nor onto, where [x] denotes the greatest integer less than or equal to x.

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93. Let R be a relation in the set N of natural numbers given by $R = \{(a, b) : a = b - 2\}$. Choose the correct answer.a)$(2, 3) \in R$ b) $(3, 8) \in R$ c)$(6, 8) \in R$ d)$(8, 7) \in R$

A. $(2, 3) \in R$

B. $(3, 8) \in R$

C. $(6, 8) \in R$

D. $(8, 7) \in R$

Answer:

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94. Let $*$ be a binary operation on the set Z of integers as $a * b = a + b + 1$. Then find the identity element:

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95. Let $A = R - \{3\}$ and $B = R - \{1\}$

Consider the function $f: A \to B$ defined by

$$f(x) = \frac{x-2}{x-3}$$

Is f one-one and onto? Justify your answer.

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96. Let $A = R - \{3\}$and $B = R - \{1\}$

consider the function $f: A \to B$ defined by

$f(x) = \frac{x-2}{x-3}$.Is it invertible?Why?

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97. Let $A = R - \{3\}$and $B = R - \{1\}$ consider the function $f: A \to B$ defined by $f(x) = \dfrac{x-2}{x-3}$.If invertible,find inverse of f(x).

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98. If $f(x) = \sin x, g(x) = x^2, x \in R$, then find $(fog)(x)$

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99. Let u and v be two functions defined on R as $u(x) = 2x - 3$ and $v(x) = \frac{3+x}{2}$ .Prove that u and v are inverse to each other.

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100. The function P is defined as "to each person on the earth is assigned a date of birth." is this a function one-one? Give reason.

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101. Consider the function $f: \left[0, \frac{\pi}{2}\right] \to R$ given by $f(x) = \sin x$ and $g: \left[0, \frac{\pi}{2}\right] \to R$ given by $g(x) = \cos x$.

Show that f and g are one-one functions.

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102. Consider the function $f: \left[0, \frac{\pi}{2}\right] \to R$ given by $f(x) = \sin x$ and $g: \left[0, \frac{\pi}{2}\right] \to R$ given by $g(x) = \cos x$.

Is $f + g$ one-one?Why?

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103. The number of one-one function from a set containing 2 elements to a set containing 3 element is.....a)2 b)3 c)6 d)8

A. 2

B. 3

C. 6

D. 8

Answer:

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104. If $f(x) = \frac{x}{x-1}$,$x \neq 1$

Find fof(x)

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105. if $f(x) = \frac{x}{x-1}$,$x \neq 1$find the inverse of

f

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106. Let

$A = N \times N$ and $*$

be a binary operation on A defined by (a,b)* (c,d) = (a + c,b + d)

Find (1,2)*(2,3)

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107. Let A=NxN and '*' be a binary operation on A defined by (a,b)*(c,d)=(a+c,b+d) .Prove that '*' is commutative.

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108. Let $A = N \times N$ and let * be a binary operation on A defined by

$(a, b)*(c, d)=(ac, bd)$ show that

(i) $(A,*)$ is associative

(ii)$(A,*)$ is commutative

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109. Let R be relation defined on $A = \{1, 2, 3\}$ by $R = \{(1, 3), (3, 1), (2, 2)\}$ is

A. Reflexive

B. Symmetric

C. Transitive

D. Reflexive but not transitive

Answer:

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110. Find fog and gof if f (x)=$|x|+1$ and g(x)=2x-1

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111. Let $*$ be a binary operation defined on $N \times N$ by $(a, b) * (c, d) = (a + c, b + d)$

Find the identity element for $*$ if it exists.

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112. Prove that the function $f: R \to R$ given by $f(x) = 2x$ is one-one and onto.

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113. The function $f: N \to N$ given by $f(x) = 2x$

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114. The function $f: N \to N$ given by $f(x) = 2x$

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115. The function $f: N \to N$ given by $f(x) = 2x$

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116. Find $gof(x)$, if $f(x) = 8x^3$ and $g(x) = x^{\frac{1}{3}}$

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117. Let $*$ be an operation such that $a * b = LCM$ of a and b defined on the set

$A = \{1, 2, 3, 4, 5\}$. Is $*$ a binary operation? Justify your answer.

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118. What is the minimum number of pairs to form a non - zero reflexive relation on a set of n elements?

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119. On the set R of real numbers, S is a relation defined as

$S = \{(x, y) / x \in R, y \in R, x + y = xy\}$.

Find $a \in R$ such that 'a' is never the first element of an ordered pair in S. Also find $b \in R$ such that 'b' is never the second element of an ordered pair in S.

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120. Consider the function $f(x) = \frac{3x+4}{x-2}, x \neq 2$. Find a function on a suitable domain such that $gof(x) = x = fog(X)$.

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121. Let R be the relation on the set N of natural numbers given by

$R = \{(a, b) : a - b > 2b > 3\}$

Choose the correct answer

A. $(4, 1) \in R$

B. $(5, 8) \in R$

C. $(8, 7) \in R$

D. $(10, 6) \in R$

Answer:

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122. If $f(x) = 8x^3$ and $g(x) = x^{\frac{1}{3}}$, find $g(f(x))$ and $f(g(x))$

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123. Let $*$ be a binary operation on the set Q of rational numbers defined by $a * b = \frac{ab}{3}$. Check whether $*$ is commutative and associative?

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124. Consider $f: R \to R$ given by $f(x) = 5x + 2$

Show that f is one-one.

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125. Consider $f: R \to R$ given by $f(x) = 5x + 2$

Is f invertible? Justify your answer.

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126. Let $*$ be a binary operation on N defined by $a * b = HCF$ of a and b

Is $*$ commutative?

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127. Let $*$ be a binary operation on N defined by $a * b = HCF$ of a and b

Is $*$ associative?

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128. *:$R \times R \to R$ is given by$a * b = 3a^2 - b$ .Find the value of 2*3.Is * commutative?Justify your answer.

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129. $f: R \to R$ is defined by $f(x) = x^2 - 3x + 2$ Find $fof(x)$ and $fof(1)$.

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130. Give a relation on a set $A = \{1, 2, 3, 4\}$ which is reflexive, symmetric and not transitive.

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131. Show that $f:[-1,1] \to R$ given by $f(x) = \dfrac{x}{x+2}$ is one-one.

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132. Let $'*'$ be a binary operation on Q^+ defined by $'a * b = \dfrac{ab}{6}'$. Find the inverse of 9 with respect to $'*'$.

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Exercise

1. If the mapping of f and g are given by F= {(1,2),(3,5),(4,1) ang g={(2,3),(5,1),(1,3)} then write fog.

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2. Give an example of a relation, which is Reflexive and symmetric but not transitive

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3. Let $*$ ' be the binary operation on N given by $a * ' b$= L.c.m. of a and b. Find $5 * 7, 20 * 16$

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4. Let $*$ ' be the binary operation on N given by $a * ' b$= L.c.m. of a and b. Is $*$ commutative ?

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5. Let* be the binary operation on N given by a*b=LCM of a and b,Is * associative?

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6. Let* be the binary operation on N given by a*b=LCM of a and b.Find the identity of * in N

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7. Let* be the binary operation on N given by a*b=LCM of a and b.Which element of N are invertible for the operation*?

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8. Function f: $R \to R$ are defined respectively,by

$f(x) = x^2 + 3x + 1, g(x) = 2x - 3$,find fog

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9. Function $f: R \to R$ are defined respectively,by

$f(x) = x^2 + 3x + 1, g(x) = 2x - 3$,find gof

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10. Show that the function $f: R \to R$ given by $f(x) = x + x^3$is a bijective function.

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