MATHS

BOOKS - NCERT MATHS (HINGLISH)

RELATIONS AND FUNCTIONS

Relations And Functions

1. 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 it reflexive and transitive.

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2. Let D be the domain of the real valued function f defined by $f(x) = \sqrt{25 - x^2}$. Then, write D.

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3. If $f, g: R \to R$ be defined by $f(x) = 2x + 1$ and $g(x) = x^2 - 2, \forall x \in R,$ respectively. Then , find gof .

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4. Let $f: R \to R$ be the function defined by $f(x) = 2x - 3, \forall x \in R.$ Write f^{-1}.

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5. Let $A = \{a, b, c, d\} and f : A\overrightarrow{A}$ be given by $f = \{(a, b), (b, d), (c, a), (d, c)\}$, write f^{-1}.

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6. If $f : R \rightarrow R$ is defined by $f(x) = x^2 - 3x + 2$, write $f\{f(x)\}$.

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7. Is $g = \{(1, 1), (2, 3), (3, 5,), (4, 7)\}$ a function? If this is described by the formula, $g(x) = \alpha x + \beta$, then what values should be assigned to α and β?

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8. Are the following set of ordered pairs functions? If so, examine whether the mapping is injective or surjective: $\{(x, y) : x$ is a person, y is the mother of $x\}$ (ii) $\{(a,\ b) : a$ is a person, b is an ancestor of $a\}$

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9. If the functions f and g are given by $f = \{(1,\ 2),\ (3,\ 5),\ (4,\ 1)\}$ and $g = \{(2,\ 3),\ (5,\ 1),\ (1,\ 3)\}$, find range of f and g. Also, write down fog and gof as sets of ordered pairs.

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10. Let C be the set of complex numbers. Prove that the mapping $F: C \to R$ given by $f(z) = |z|, \forall z \in C,$ is neither one-one nor onto.

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11. Let the function $f: R \to R$ be defined by $f(x) = \cos x, \forall x \in R.$ Show that f is neither one-one nor onto.

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12. Let X = { 1, 2, 3} and Y= {4, 5}. Find whether the following subsets of $X \times Y$ are functions from X to Y or not.

(i) f = {(1, 4), (1, 5), (2, 4), (3, 5)} (ii) g = {(1, 4), (2, 4), (3, 4)}

(iii) h = {(1, 4), (2, 5), (3, 5) } (iv) k = {(1, 4), (2, 5)}

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13. If functions $f: A \rightarrow B$ and $g: B \rightarrow A$ satisfy $gof = I_A$, then show that f is one-one and g is onto.

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14. Let $f: R \rightarrow R$ be the function defined by $f(x) = \frac{1}{2 - \cos x}, \forall x \in R$. Then, find the range fo f.

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15. Let n be a fixed positive integer. Define a relation R on Z as follows:

$(a, b) \in R \Leftrightarrow a - b$ is divisible by n. Show that R is an equivalence relation on Z.

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16. If A = {1, 2, 3, 4}, define relations on A which have properties of being

(i) reflexive, transitive but not symmetric.

(ii) symmetric but neither reflexive nor transitive.

(iii) reflexive, symmetric and transitive.

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17. Let R be a relation defined on the set of natural numbers N as $R = \{(x, y) : x, y \in N, 2x + y = 41\}$ Find the domain and range of R. Also, verify whether R is (i) reflexive, (ii) symmetric (iii) transitive.

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18. Given, $A = \{2, 3, 4\}, B = \{2, 5, 6, 7\}$. Construct an example of each of the following

(i) an injective mapping from A to B.

(ii) a mapping from A to B which is not injective.

(iii) a mapping from B to A.

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19. Give an example of a function which is one-one but not onto. which is not one-one but onto. (iii) which is neither one-one nor onto.

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20. Let $A = R - \{2\}$ and $B = R - \{1\}$. If $f: A \to B$ is a mapping defined by $f(x) = \frac{x-1}{x-2}$, show that f is bijective.

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21. Let $A = [-1, 1]$. Then, discuss whether the following functions from A to itself are one-one onto or bijective: $f(x) = \frac{x}{2}$ (ii) $g(x) = |x|$ (iii) $h(x) = x^2$

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22. Each of the following defines a relation on N:

(i) $x > y,\ x,\ y \in N$

(ii) $x + y = 10,\ x,\ y \in N$

(iii) xy is square of an integer, $x,\ y \in N$

(iv) $x + 4y = 10,\ x,\ y \in N$

Determine which of the above relations are reflexive, symmetric and transitive.

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23. Let $A = \{1, 2, 3, , 9\}$ and R be the relation on $A \times A$ defined by $(a, b) R (c, d)$ if $a + d = b + c$ for all $(a, b), (c, d) \in A \times A$. Prove that R is an equivalence relation and also obtain the equivalence class [(2, 5)].

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24. Using the definition, Prove that the function $f : A \to B$ is invertible if and only if f

is both one-one and onto.

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25. If $f, g : R\overrightarrow{R}$ are defined respectively by $f(x) = x^2 + 3x + 1, g(x) = 2x - 3,$ find fog (ii) gof (iii) fof (iv) gog.

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26. Let $*$ be the binary operation defined on Q. Find which of the following binary operations are commutative

(i) $a * b = a - b, \forall a, b \in Q$

(ii) $a * b = a^2 + b^2, \forall a, b \in Q$

(iii) $a * b = a + ab, \forall a, b \in Q$

(iv) $a * b = (a - b)^2, \forall a, b \in Q$

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27. Let * be a binary operation on R defined by $a \cdot b = ab + 1$. Then, * is commutative but not associative associative but not commutative neither commutative nor associative (d) both commutative and associative

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28. Let T be the set of all triangles in a plane with R a relation in T given by $R = \{(T_1, T_2) : T_1 (is congruent to T)_2\}$. Show that R is an equivalence relation.

A. reflexive but not transitive

B. transitive but not symmetric

C. equivalence

D. None of these

Answer: C

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29. Consider the non-empty set consisting of children in a family and a relation R defined as aRb, if a is brother of b. Then, R is

A. symmetric but not transitive

B. transitive but not symmetric

C. neither symmetric nor transitive

D. both symmetric and transitive

Answer: B

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30. The maximum number of equivalence relations on the set A = {1, 2, 3} are

A. 1

B. 2

C. 3

D. 5

Answer: D

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

A. reflexive

B. transitive

C. symmetric

D. None of these

Answer: B

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32. Let us define a relation R in R as aRb if $a \geq b$. Then, R is

A. an equivalence relation

B. reflexive, transitive but not symmetric

C. symmetric, transitive but not reflexive

D. neither transitive nor reflexive but symmetric

Answer: B

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33. If A = {1, 2, 3} and consider the relation

R ={(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)}

Then, R is

A. reflexive but not symmetric

B. reflexive but not transitive

C. symmetric and transitive

D. neither symmetric nor transitive

Answer: A

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34. The identity element for the binary operation * defined on Q - {0} as $a * b = \frac{ab}{2}, \forall a, b \in Q - \{0\}$ is

A. 1

B. 0

C. 2

D. None of these

Answer: C

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35. If the set A contains 5 elements and the set B contains 6 elements, then the number of one-one and onto mappings from A to B is 720

(b) 120 (c) 0 (d) none of these

A. 720

B. 120

C. 0

D. None of these

Answer: C

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36. Let $A = \{1, 2, \ldots, n\}$ and $B = \{a, b\}$.

Then number of subjections from A into B is

nP2 (b) $2^n - 2$ (c) $2^n - 1$ (d) nC2

A. ${}^nP_2$

B. $2^n - 2$

C. $2^n - 1$

D. None of these

Answer: D

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37. If $f: R \to R$ be defined by $f(x) = \frac{1}{x}, \forall x \in R$. Then , f is

A. one-one

B. onto

C. bijective

D. f is not defined

Answer: D

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38. If $f: R \rightarrow R$ be defined by $f(x) = 3x^2 - 5$ and $g: R \rightarrow R$ by $g(x) = \frac{x}{x^2 + 1}$. Then, gof is

A. $\frac{3x^2 - 5}{9x^4 - 30x^2 + 26}$

B. $\frac{3x^2 - 5}{9x^4 - 6x^2 + 26}$

C. $\frac{3x^2}{x^4 + 2x^2 - 4}$

D. $\frac{3x^2}{9x^4 + 30x^2 - 2}$

Answer: A

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39. Which of the following functions from Z to itself are bijections? a

A. $f(x) = x^3$

B. $f(x) = x + 2$

C. $f(x) = 2x + 1$

D. $f(x) = x^2 + 1$

Answer: B

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40. $f : R \rightarrow R$ defined by $f(x) = x^2 + 5$

A. $(x + 5)^{\frac{1}{3}}$

B. $(x - 5)^{\frac{1}{3}}$

C. $(5 - x)^{\frac{1}{3}}$

D. $5 - x$

Answer: B

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41. If $f: A \to B$ and $g: B \to C$ be the bijective functions, then $(gof)^{-1}$ is

A. $f^{-1}og^{-1}$

B. fog

C. $g^{-1}of^{-1}$

D. gof

Answer: A

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42. Let $f : R - \left\{\frac{3}{5}\right\} \to R$ be defined by $f(x) = \frac{3x + 2}{5x - 3}$. Then

A. $f^{-1}(x) = f(x)$

B. $f^{-1}(x) = -f(x)$

C. $(fof)x = -x$

D. $f^{-1}(x) = \frac{1}{9}f(x)$

Answer: A

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43. If $f(x)$ is defined on $[0, 1]$ by the rule $f(x) = \{x,$ if x is rational $,1 - x,$ if x is rational ' then for all $x \in [0, 1]$,$f(f(x))$ is

A. constant

B. 1+x

C. x

D. None of these

Answer: C

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44. If $f : [2, \infty) \to R$ be the function defined by $f(x) = x^2 - 4x + 5$, then the range of f is

A. R

B. $[1, \infty)$

C. $[4, \infty)$

D. $[5, \infty)$

Answer: B

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45. Let $f : N \rightarrow R$ be the function defined by $f(x) = \frac{2x-1}{2}$ and $g : Q \rightarrow Q$ be another function defined by $g(x) = x + 2$ then $(gof)\left(\frac{3}{2}\right)$ is

A. 1

B. 1

C. $\frac{7}{2}$

D. None of these

Answer: D

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46. If $f: R \rightarrow R$ be defined by

$$f(x) = \begin{cases} 2x : x > 3 \\ x^2 : 1 < x \leq 3 \\ 3x : x \leq 1 \end{cases}$$

Then, $f(-1) + f(2) + f(4)$ is

A. 9

B. 14

C. 5

D. None of these

Answer: A

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

A. $\frac{\pi}{4}$

B. $\left\{n\pi + \frac{\pi}{4} : n \in Z\right\}$

C. Does not exist

D. None of these

Answer: A

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48. Let the relation R be defined in N by $a\ R\ b$, if $2a+3b=30$. Then R = ...

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49. If the relation R be defined on the set $A=\{1,2,3,4,5\}$ by $R=\{(a,b): |a^2-b^2|<8\}$. Then, R is given by ....

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50. If the functions f and g are given by $f=\{(1, 2), (3, 5), (4, 1)\}$ and $g=\{(2, 3), (5, 1), (1, 3)\}$, find range of f and g. Also, write down fog and gof as sets of ordered pairs.

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51. If $f: R \rightarrow R$ be defined by $f(x)=\frac{x}{\sqrt{1+x^2}}$, then $(fofof)(x)=\ldots\ldots\ldots\ldots\ldots$

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52. If $f(x) = \left[4 - (x-7)^3\right]$, then $f^{-1}(x) = \ldots\ldots\ldots\ldots$

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53. State true or false for the given statement :

Let R = { (3, 1), (1, 3), (3, 3)} be a relation defined on the set A = {1, 2, 3}. Then, R is symmetric, transitive but not reflexive.

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54. If $f: R \rightarrow R$ be the function defined by $f(x) = \sin(3x+2) \forall x \in R$. Then, f is invertible.

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55. Every relation which is symmetric and transitive is also reflexive.

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56. An integer m is said to be related to another integer n if m is a multiple of n. Check if the relation is symmetric, reflexive and transitive.

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57. Let $A = \{0, 1\}$ and the set of all natural numbers.Then the mapping $f: N \to A$ defined by $f(2n - 1) = 0,\ f(2n) = 1,\ \forall n \in N,$ is

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58. The relation R on the set A = {1, 2, 3} defined as R ={(1, 1), (1, 2), (2, 1), (3, 3)} is reflexive, symmetric and transitive.

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59. The composition of function is commutative.

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60. The composition of functtions is associative

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61. Every function is invertible.

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62. A binary operation on a set has always the identity element.

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