# MATHS

## NCERT - FULL MARKS MATHEMATICS(TAMIL)

## SETS, RELATIONS AND FUNCTIONS

**Example**

**1.** Find the number of subsets of A if $A = \{(x : x = 4n + 1, 2 \leq n \leq 5, n \in \mathbb{N})\}$.

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**2.** In a survey of 5000 persons in a town, it was found that 45% of the persons know language A, 25% know language B, 10% know Language C, 5% know Language A and B, 4% know Languages Band C, and 4% now

Languages A and C. If 3% of the persons know all the three Languages find the number of persons who knows only Language A.

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**3.** Prove that

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

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**4.** If $X = \{1, 2, 3. \ldots \ldots \ldots 10\}$ and $A = \{1, 2, 3, 4, 5\}$ find the number of sets $B \subseteq X$ such that $A - B = \{4\}$.

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**5.** If A and B are two sets so that $n(B - A) = 2n(A - B) = 4n(A \cap B)$ and if $n(A \cup B) = 14$, then find $n(\mathscr{P}(A))$.

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**6.** Two sets have m and k elements. If the total number of subsets of the first set is 112 more than that of the second set, find the values of m and k.

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**7.** If $n(A) = 10$ and $n(A \cap B) = 3$ find $n((A \cap B)' \cap A)$

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**8.** If $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6\}$ find $n((A \cup B) \times (A \cap B) \times (A \Delta B))$.

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**9.** If $\mathscr{P}(A)$ denotes the power set of A then find $n(\mathscr{P}(\mathscr{P}(\mathscr{P}(\emptyset))))$.

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**10.** Check the relation $R = \{(1, 1), (2, 2), (3, 3), \ldots\ldots, (n, n)\}$ defined on the set $S = \{1, 2, 3, \ldots\ldots\ldots\ldots, n\}$ for the three basic realtions.

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**11.** Let $S = \{1, 2, 3\}$ and $\rho = \{(1, 1), (1, 2), (2, 2), (1, 3), (3, 1)\}$.

(i) If $\rho$ refelxive? If not, state the reason and write the minimum set of ordered pairs to be included to $\rho$ so as to make it reflexive.

(ii) Is $\rho$ symmetric ? If not, state the reason, write minimum number of ordered pairs to be included to $\rho$ so as to make it symmetric and write minimum number of ordered pairs to be deleted from $\rho$ so as to make it symmetric.

(iii) Is $\rho$ transitive? If not, state the reason, write minimum number of ordered pairs to be included to $\rho$ so as to make it transitive and write minimum number of ordered pairs to be deleted from $\rho$ so as tomake it transitive.

(iv) Is $\rho$ an equivalence relation? If not, write the minimum ordered pairs to be included to $\rho$ so as to make it an equivalence relation.

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**12.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types: not reflexive, not symmetric, not transitive

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**13.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types: not reflexive, not symmetric, transitive

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**14.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types: not reflexive, symmetric, not transitive

View Text Solution

**15.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types:

not reflexive, symmetric, transitive

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**16.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types:

reflexive, not symmetric, not transitive

View Text Solution

**17.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types:

reflexive, not symmetric, transitive

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**18.** Let $A = \{0, 1, 2, 3\}$ . Construct relations on A of the following types:

reflexive, symmetric, non transitive

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**19.** In the set $\mathbb{Z}$ of integers, define m Rn if m-n is multiple of 12. Prove that R is an equivalence relation.

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**20.** Check whether of the following functions are one to one and onto.

(i) $f: \mathbb{N} \to N$ defined $f(n) = n + 2$

(ii) $f: \mathbb{N} \cup \{-1, 0\} \to \mathbb{N}$ defined by $f(n) = n + 2$.

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**21.** Check the following functions for one to oneness and onto ness and ontoness.

(i) $f: \mathbb{N} \to \mathbb{N}$ defined by $f(n) = n^2$

(ii) $f: R \to R$ defined by $f(n) = n^2$

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**22.** Check whether the following for one to one ness and ontoness.

(i) $f: \mathbb{R} \to R$ defined by $f(x) = \frac{1}{x}$

(ii) $f: R - \{0\} \to \mathbb{R}$ defined by $f(x) = \frac{1}{x}$

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**23.** If $f: \mathbb{R} - \{-1, 1\} \to \mathbb{R}$ is defined by $f(x) = \frac{x}{x^2 - 1}$, verify whether f is one to one or nto.

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**24.** If $f: R \to R$ is defined as $f(x) = 2x^2 - 1$ find the pre images of 17,4 and -2.

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**25.** If $f: [-2, 2] \to B$ is given by $f(x) = 2x^3$ then find B so that f is onto.

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**26.** Check whether the function $f(x) = x|x|$ defined on $[-2, 2]$ is one to one or not. If it is one to one find a suitable co domain so that the function becomes a bijection.

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**27.** Find the largest possible domain for the real valued function f defined by $f(x) = \sqrt{x^2 - 5x + 6}$

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**28.** Find the domain of $f(x) = \dfrac{1}{1 - 2\cos x}$

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**29.** Find the range of the function $f(x) = \dfrac{1}{1 - 3\cos x}$

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**30.** Find the largest possible domain for the real valued function given by $f(x) = \dfrac{\sqrt{9 - x^2}}{\sqrt{x^2 - 1}}$

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**31.** Let $f = \{(1, 2), (3, 4), (2, 2)\}$ and $g = \{(2, 1), (3, 1), (4, 2)\}$ Find g o f and f o g.

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**32.** Let $f = \{(1, 4), (2, 5), (3, 5)\}$ and $g = \{(4, 1), (5, 2), (6, 4)\}$. Find g o f. Can you find f o g ?

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**33.** Let f and g be the two functions from $\mathbb{R}$ to $\mathbb{R}$ defined by $f(x) = 3x - 4$ and $g(x) = x^2 + 3$. Find g o f and f o g

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**34.** Show that the statement.

if f and g of are one to one then g is one to one is not true.

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**35.** Let $f, g: \mathbb{R} \to \mathbb{R}$ be defined as $f(x) = 2x - |x|$ and $g(x) = 2x + |x|$.

Find f o g .

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**36.** If $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 2x - 3$ prove that f is a bijection and find its inverse.

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## Exercise 1 1

**1.** Write the following in roster form.

$\{x \in N: x^2 < 121 \text{ and } x \text{ is a prime}\}$

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**2.** Write the following in roster form.

the set of all positive roots of the equation $(x-1)(x+1)\left(x^2-1\right)=0$

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**3.** Write the following in roster form.

$\{x \in \mathbb{N}: 4 \times 9 < 53\}$

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**4.** Write the following in roster form.

$\left\{x: \frac{x-4}{x+2}=3, x \in \mathbb{R}-\{-2\}\right\}$

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**5.** Write the set {-1,1} is set builder form.

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**6.** State whether the following sets are finite or infinite.

$\{x \in \mathbb{N} : x \text{is an even prime number}\}$

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**7.** State whether the following sets are finite or infinite.

$\{x \in \mathbb{N} : x \text{is an odd prime number}\}$

View Text Solution

**8.** State whether the following sets are finite or infinite.

$\{x \in \mathbb{Z} : \text{x is even and less than } 10\}$

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**9.** State whether the following sets are finite or infinite.

$\{x \in \mathbb{R} : \text{x is rational number}\}$

View Text Solution

**10.** State whether the following sets are finite or infinite.

$\{x \in \mathbb{N} : \text{x is rational number}\}$

View Text Solution

**11.** Jusify the trueness of the statement

An element of a set can never be a subset of itself.

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**12.** If $n(A \cap B) = 3$ and $n(A \cup B) = 10$, then find $n(\mathscr{P}(A \Delta B))$

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**13.** For a set $A$, $A \times A$ contains 16 elements and two of its elements are (1,3) and (0,2). Find the element of A.

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**14.** Let A and B be two such that $n(A) = 3$ and $n(B) = 2$. If $(x, 1), (y, 2), (z, 1)$ are in $A \times B$, find A and B where $x, y, z$ are distinct elements.

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**15.** If$A \times A$ has 16 elements $A = \{(a, b) \in A \times A : a < \}, (-1, 2)$ and (0,1) are two elements of S, then find the remaining element of S.

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Exercise 1 2

**1.** Discuss the following relations for reflexivity, symmetricity and transitivity:

The relation R defined on the set of all positive integers by mRn if m divides n.

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**2.** Discuss the following relations for reflexivity, symmetricity and transitivity:

Let P denote the set of al straight lines in a plane. The relation R defined by l Rnm if l is perpendicular to m.

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**3.** Discuss the following relations for reflexivity, symmetricity and transitivity:

let A be the consisting of all the members of a family. The relation R defined by a Rb if a is not a sister of b.

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**4.** Discuss the following relations for reflexivity, symmetricity and transitivity:

Let A be the set consisting of all the female members of a family. The relation R defined by a Rb if a is not a sister of b.

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**5.** Discuss the following relations for reflexivity, symmetricity and transitivity:

On the set of natural numbers the relation R defined by x Ry if $x + 2y = 1$.

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**6.** Let $X = \{a, b, c, d\}$ and $R = \{(a, a), (b, b), (a, c)\}$. Write doen the minimum number of ordered pairs to be included to R to make it

(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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**7.** Let $A = \{a, b, c\}$ and $R = \{(a, a), (b, b), (a, c)\}$. Write down the minimum number of ordered pairs to be included to R to make it

(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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**8.** On the set of natural numbers let R be the relation defined by a Rb if $2a + 3b = 30$. Write down the relation by listing all the pairs. Check whether it is

(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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**9.** On the set of natural numbers let R be the relatioin defined by aRb if $a + b \leq 6$. Write down the relation by listing all the pairs. Check whether it is

(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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**10.** Let $A = \{a, b, c\}$ . What is the equivalence relation of smallest cardinality of A? What is the equivalence relationi of largest cardinality on A?

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## Exercise 1 3

**1.** Suppose that 120 are studying in 4 sections of eleventh standard in a school. Let A denote the set of students and B denote the set of the sections. Define a relation from A to B as x related to y if the student x

belongs to the section y. Is this relation a function? What can you say about the inverse relatioin. Explain your answer.

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**2.** Write the values of at -4,1,-2,7,0 if

$$f(x) = \begin{cases} -x+4 & \text{if} -\infty < x \leq -3 \\ x+4 & \text{if} -3 < x < -2 \\ x^2 - x & \text{if} -2 \leq x < 1 \\ x - x^2 & \text{if} 1 \leq x < 7 \\ 0 & \text{otherwise} \end{cases}$$

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**3.** Write the vaues of f at -3,5,2-1,0 if

$$f(x) = \begin{cases} x^2 + x - 5 & \text{if} x \in (-\infty, 0) \\ x^2 + 3x - 2 & \text{if} x \in (3, \infty) \\ x^2 & \text{if} x \in (0, 2) \\ x^2 - 3 & \text{otherwise} \end{cases}$$

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**4.** State whether the following relations are functions or not. If it is a function check for one to oneness and ontoness. If it is not a function, state why?

(i) If $A = \{a, b, c\}$ and $f = \{(a, c), (b, c), (c, b)\}$, $(f: A \to A)$

(ii) If $X = \{x, y, z)$ and $f = \{(x, y), (x, z), (z, x)\}$, $(f: X \to X)$

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**5.** Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$. Give a function from $A \to B$ for each of the following:

(i) neither one to one nor onto

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**6.** Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$. Give a function from $A \to B$ for each of the following:

not one to one but onto.

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**7.** Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$. Give a function from $A \to B$ for each of the following:

one to one but not onto.

View Text Solution

**8.** Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$. Give a function from $A \to B$ for each of the following:

one to one and onto.

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**9.** Find the domain of $\frac{1}{1 - 2\sin x}$

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**10.** Find the largest possible domain of the real valued function $f(x) = \frac{\sqrt{4 - x^2}}{\sqrt{x^2 - 9}}$

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**11.** Find the range of the function $\frac{1}{2\cos x - 1}$

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**12.** Show that the relation $xy = -2$ is a function for a suitable domain.

Find the domain and the range of the function.

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**13.** If $f, g: R \to R$ are defined by $f(x) = |x| + x$ and $g(x) = |x| - x$ find g o f and f o g.

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**14.** If $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = 3x - 5$, prove that f is a bijection and find its inverse.

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**15.** The weight of the muscles of a man is a function of his body weight x and can be expressed as $W(x) = 0.35x$. Determine the domain of this function.

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**16.** The total cost of airfare on a given route is comporised of the base cost C and the fuel surcharge S in rupee. Both C and S are functions of the mileage$m$, $C(m) = 0.4m + 5$ and $S(m) = 0.03m$. Determine a function for the total cost of a ticket in terms of the mileage and find the airfare for flying 1600 miles.

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**17.** A sales person whose annual earnings can be represented by the function $A(x) = 30,000 + 0.4x,$ where x is the rupee value of the merchandise he sells. His on is also in sales and his earnings are represented by the function $S(x) = 25,000 + 0.05x$. Find $(A + S)(x)$ and determine the total family income if they each sell Rupees 1,50,00,000 worth of merchandise.

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**18.** The function for exchanging Americal dollars for Singapore Dollar on a given day isd $f(x) = 1.23x$, where x represents the number of Americal dollars. On the same day the function for exchanging Singapore Dollar to Indian Rupee is $g(y) = 50.50y$, where y represents the number of Singapore dollars. Write a function which will give exchange rate of Americal dollars in terms of Indian rupee.

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**19.** The owner of a small restaurant can prepare a particular meal at a csot of Rupees 100. He estimates that if the menu price of the meal is x rupees, then the number of customers who will order that meal at that price in an evening is given by the function $D(x) = 200 - x$. Express his day revenue, total cost and profit on this meal as functions of x.

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**20.** The formula for converting from Fahrenheit to Celsius temperautee is $y = \frac{5x}{9} - \frac{160}{9}$. Find the inverse of this function and determine whether the invere is also a function.

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**21.** A simple cipher takes a number and codes it, using the function $f(x) = 3x - 4$. Find the inverse of this function determine whether the inverse is also a function and verify the symmetrical property about the line y=x (by drawing the lines).

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## Exercise 1 5

**1.** If $A = \{(x, y) : y = e^x, x \in R\}$ and $B = \{(x, y), : y = e^{-x}, x \in R\}$ then $n(A \cap B)$ is

A. Infinity

B. 0

C. 1

D. 2

**Answer: C**

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**2.** If $A = \{(x, y) : y = \sin x, x \in R\}$ and $B = \{(x, y) : y = \cos x, x \in R\}$ then $A \cap B$ contains

A. no element

B. infinitely many elements

C. only one element

D. cannot be determined.

**Answer: B**

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**3.** The relation R defined on a set $A = \{0, -1, 1, 2\}$ by x Ry if $\left|x^2 + y^2\right| \leq 2$ then which one of the following is true?

A. $R = \{(0, 0), (0, -1), (0, 1), (-1, 0), (-1, 1), (1, 2), (1, 0)\}$

B. $R^{-1} = \{(0, 0), (0, -1), (0, 1), (-1, 0), (1, 0)\}$

C. Domain of R is $\{0, -1, 1, 2\}$

D. Range of R is $\{0, -1, 1\}$

**Answer: D**

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**4.** If $f(x) = |x-2| + |x+2|, x \in R$ then

A. $f(x) = \begin{cases} -2x & \text{If } x \in (-\infty, -2] \\ 4 & \text{if } x \in (-2, 2] \\ 2x & \text{if } x \in (2, \infty) \end{cases}$

B. $f(x) = \begin{cases} 2x & \text{If } x \in (-\infty, -2] \\ 4 & \text{if } x \in (-2, 2] \\ -2x & \text{if } x \in (2, \infty) \end{cases}$

C. $f(x) = \begin{cases} -2x & \text{If } x \in (-\infty, -2] \\ -4x & \text{if } x \in (-2, 2] \\ -2x & \text{if } x \in (2, \infty) \end{cases}$

D. $f(x) = \begin{cases} -2x & \text{If } x \in (-\infty, -2] \\ 2x & \text{if } x \in (-2, 2] \\ 2x & \text{if } x \in (2, \infty) \end{cases}$

**Answer: A**

View Text Solution

**5.** Let $\mathbb{R}$ be the set of all real numbers. Consider the following subsets of the plane $\mathbb{R} \times \mathbb{R}$

$S = \{(x, y) : y = x + 1 \quad \text{and} \quad 0 < x < 2\} \quad \text{and}$

$T = \{(x, y) : x - y \text{is an integer}\}$

Then which of the following is true?

A. T is an equivalence relation but S is not an equivalence relation.

B. Neither S nor T is an equivalence relation

C. Both S and T are equivalence relatioin

D. S is an equivalence relation but T is not an equivalcne relation.

**Answer: A**

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**6.** Let A and B be subsets of the universal set $\mathbb{N}$, the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is

A. A

B. A'

C. $B$

D. $\mathbb{N}$

**Answer: D**

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**7.** The number of students who take both the subjects Mathematics and Chemistry is 70. This represents 10% of the enrollment in Mathematics and 14% of the enrollment in Chemistry. The number of student take at least one of these two subjects is

A. 1120

B. 1130

C. 1100

D. insufficient data

**Answer: B**

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**8.** If $n((A \times B) \cap (A \times C)) = 8$ and $n(B \cap C) = 2$ then $n(A)$ is

A. 6

B. 4

C. 8

D. 16

**Answer: B**

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**9.** If $n(A) = 2$ and $n(B \cup C) = 3$ then $n[(A \times B) \cup (A \times C)]$ is

A. $2^3$

B. $3^2$

C. $6$

D. $5$

**Answer: C**

View Text Solution

**10.** If two sets A and B have 17 elements in common, then the number of elements common to the set $A \times B$ and $B \times A$ is

A. $2^{17}$

B. $17^2$

C. $34$

D. insufficient data

**Answer: B**

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**11.** For non empty set A and B if $A \subset B$ then $(A \times B) \cap (B \times A)$ is equal to

A. $A \cap B$

B. $A \times A$

C. $B \times B$

D. None of these

**Answer: B**

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**12.** The number of relations on a set containing 3 elements is

A. 9

B. 81

C. 512

D. 1024

**Answer: C**

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**13.** Let R be the universal relation on a set X with more than one element.

Then R is

A. not reflexive

B. not symmetric

C. transitive

D. None of the above

**Answer: C**

View Text Solution

**14.** Let $X = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (1, 3), (2, 2), (3, 3), (2, 1), (3, 1), (1, 4), (4, 1)\}$.

Then R is

A. reflexive

B. symmetric

C. transitive

D. equivalence

**Answer: B**

View Text Solution

**15.** The range of the function $\frac{1}{1-\sin x}$ is

A. $(-\infty, -1) \cup \left(\frac{1}{3}, \infty\right)$

B. $\left(-1, \frac{1}{3}\right)$

C. $\left[-1, \frac{1}{3}\right]$

D. $(-\infty, -1] \cup \left[\frac{1}{3}, \infty\right)$

**Answer: D**

View Text Solution

**16.** The range of the function $f(x) = |\lfloor(x) - x|, x \in \mathbb{R}$ is

A. $[0, 1]$

B. $[0, \infty)$

C. $[0, 1)$

D. $(0, 1)$

**Answer: C**

View Text Solution

**17.** The rule $f(x) = x^2$ is a bijectionif the domain and the co domain are given by

A. $\mathbb{R}, \mathbb{R}$

B. $\mathbb{R}, (0, \infty)$

C. $(, \infty), \mathbb{R}$

D. $[0, \infty), [0, \infty)$

**Answer: D**

View Text Solution

**18.** The number of constant functions from a set containing m elements to a set containing n elements is

A. mn

B. m

C. n

D. m+n

**Answer: C**

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**19.** The function $f: [0, 2\pi] \to [-1, 1]$ defined by f(x)=sin x is

A. one to one

B. onto

C. bijection

D. cannot be determined.

**Answer: B**

View Text Solution

**20.** If the function $f:[-3,3] \to S$ defined by $f(x) = x^2$ is onto then S is

A. $[-9,9]$

B. $\mathbb{R}$

C. $[-3,3]$

D. $[0,9]$

**Answer: D**

View Text Solution

**21.** Let $X = \{1, 2, 3, 4\}, Y = \{a, b, c, d\}$ and $f = \{(1, a), (4, b), (2, c), (3, d), (2, d)\}$. Then f is

A. an one to one function

B. an onto function

C. a function which is not one to one

D. not a function

**Answer: D**

View Text Solution

**22.** The inverse of $f(x) = \begin{cases} x & \text{if } x < 1 \\ x^2 & \text{if } 1 \leq x \leq 4 \\ 8\sqrt{x} & \text{if } x > 4 \end{cases}$ is

A. $f^{-1}(x) = \begin{cases} x & \text{if } x < 1 \\ \sqrt{x} & \text{if } 1 \leq x \leq 16 \\ \frac{x^2}{64} & \text{if } x > 16 \end{cases}$

B. $f^{-1}(x) = \begin{cases} -x & \text{if } x < 1 \\ \sqrt{x} & \text{if } 1 \leq x \leq 16 \\ \frac{x^2}{64} & \text{if } x > 16 \end{cases}$

C. $f^{-1}(x) = \begin{cases} x^2 & \text{if } x < 1 \\ \sqrt{x} & \text{if } 1 \leq x \leq 16 \\ \frac{x^2}{64} & \text{if } x > 16 \end{cases}$

D. $f^{-1}(x) = \begin{cases} 2x & \text{if } x < 1 \\ \sqrt{x} & \text{if } 1 \leq x \leq 16 \\ \frac{x^2}{8} & \text{if } x > 16 \end{cases}$

**Answer: A**

View Text Solution

**23.** Let $f: \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 1 - |x|$. Then the range of f is

A. $\mathbb{R}$

B. $(1, \infty)$

C. $(-1, \infty)$

D. $(-\infty, 1]$

**Answer: D**

View Text Solution

**24.** The function $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = \sin x + \cos x$ is

A. an odd function

B. neither an odd function nor an even function

C. an even function

D. both odd function and even function.

**Answer: B**

View Text Solution

**25.** The function $f: \mathbb{R} \to \mathbb{R}$ is defined by

$$f(x) = \frac{\left(x^2 + \cos x\right)\left(1 + x^4\right)}{(x - \sin x)(2x - x^3)} + e^{-|x|}$$ is

A. an odd function

B. neither an odd function nor an even function

C. an even function

D. both odd function and even function.

**Answer: C**

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