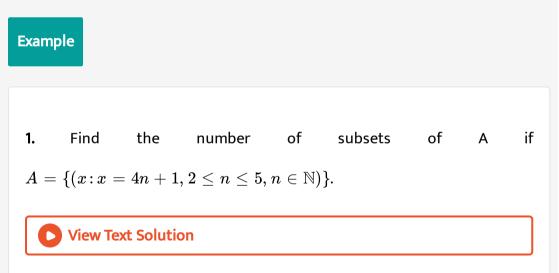


# MATHS

# NCERT - FULL MARKS MATHEMATICS(TAMIL)

# SETS, RELATIONS AND FUNCTIONS



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.

**View Text Solution** 

### 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  $X = \{1, 2, 3, \ldots, 10\}$  and  $A = \{1, 2, 3, 4, 5\}$  find the number

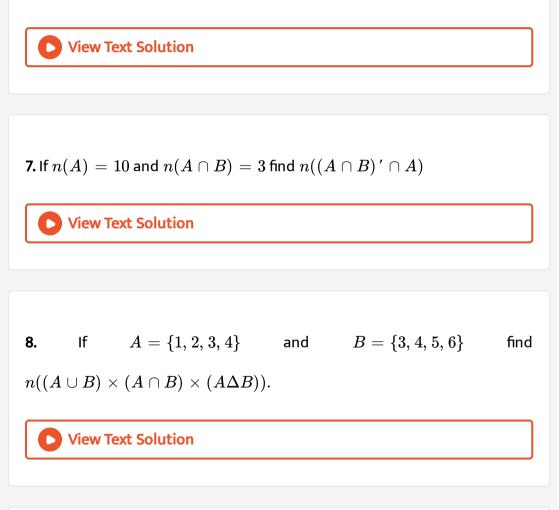
of sets  $B \subseteq X$  such that  $A - B = \{4\}$ .

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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  $n(\mathscr{P}(A)).$ 

**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.



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



**10.** Check the relation  $R = \{(1, 1), (2, 2), (3, 3), \dots, (n, n)\}$  defined

on the set  $S = \{1, 2, 3, \ldots, n\}$  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.



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

not reflexive, not symmetric, not transitive



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

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

not reflexive, symmetric, transitive



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

reflexive, not symmetric, not transitive

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

reflexive, not symmetric, transitive

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

reflexive, symmetric, non transitive



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

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

ontoness.

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

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

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

(i)  $f\colon \mathbb{R} o R$  defined by  $f(x)=rac{1}{x}$ (ii)  $f\colon R-\{0\} o \mathbb{R}$  defined by  $f(x)=rac{1}{x}$ 

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23. If  $f\colon \mathbb{R}-\{-1,1\} o \mathbb{R}$  is defined by  $f(x)=rac{x}{x^2-1}$  , verify whether

f is one to one or nto.

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

and -2.

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

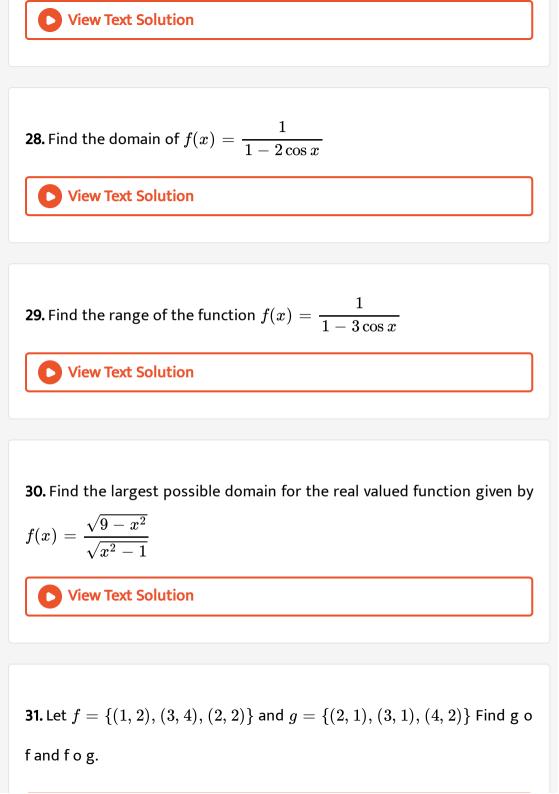
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**26.** Check whether the function f(x) = x|x| defined on [-2, 2] is one to one or not. If it is one to one find a suitable co domain so that the function becomes a bijection.



27. Find the largest possible domain for the real valued function f defined

by 
$$f(x)=\sqrt{x^2-5x+6}$$



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

of. Can you find fog?

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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 of 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.



**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 .

View Text Solution

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

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Exercise 11

1. Write the following in roster form.

 $ig\{x\in N\!:\!x^2<121 \hspace{0.2cm} ext{and} \hspace{0.2cm}x \hspace{0.2cm} ext{is a prime}ig\}$ 

2. Write the following in roster form.

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



3. Write the following in roster form.

 $\{x\in\mathbb{N}\!:\!4 imes9<53\}$ 

View Text Solution

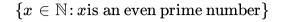
4. Write the following in roster form.

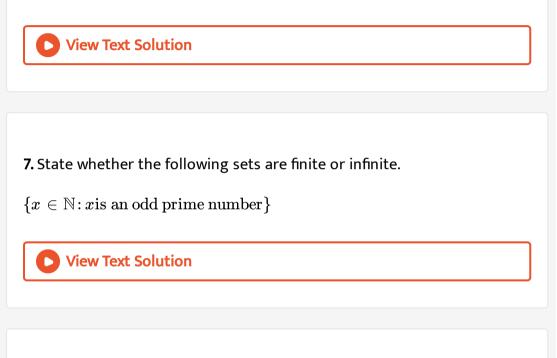
$$\left\{x\!:\!rac{x-4}{x+2}=3,x\in\mathbb{R}-\{-2\}
ight\}$$

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

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





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

 $\{x\in\mathbb{Z}\!:\!\mathrm{x} ext{ is even and less than }10\}$ 

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

```
\{x\in\mathbb{R}\!:\!\mathrm{x}	ext{ is rational number}\}
```



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

 $\{x\in\mathbb{N}\!:\!\mathrm{x} ext{ is rational number}\}$ 

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11. Jusify the trueness of the statement

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



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

**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.



**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 imes A has 16 elements  $A = \{(a,b) \in A imes A : a < \}, (-1,2)$  and

(0,1) are two elements of S, then find the remaining element of S.

**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 I Rnm if I 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.

**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

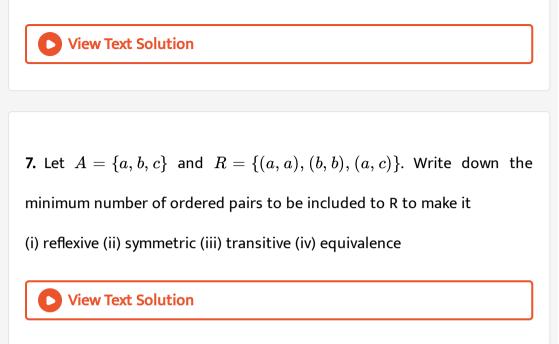
x + 2y = 1.

View Text Solution

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



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

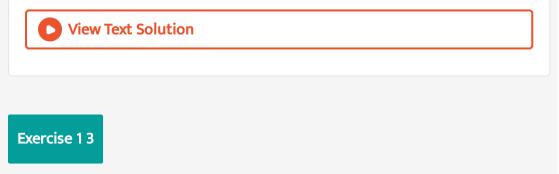
(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

9. On the set of natural numbers let R be the relation 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

# View Text Solution

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?



**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.





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

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

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

**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  $f=\{(a,c),(b,c),(c,b)\},(f\!:\!A
ightarrow A)$ 

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

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5. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{a, b, c, d\}$ . Give a function from A o 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 o B

for each of the following:

not one to one but onto.



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 o B

for each of the following:

one to one and onto.

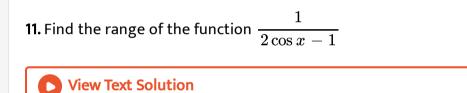
View Text Solution

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

10. Find the largest possible domain of the real valued function

$$f(x)=rac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$$

View Text Solution



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

Find the domain and the range of the function.



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

find g o f and f o g.

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.

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 mileagem, 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.

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.

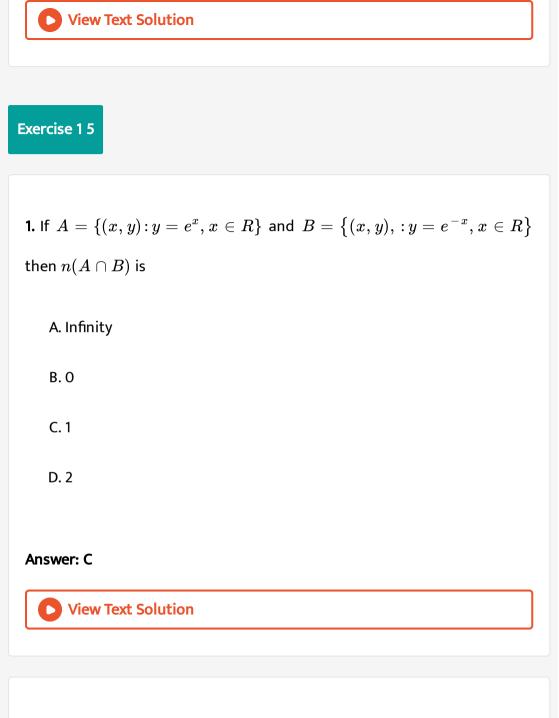
**19.** The owner of a small restaurant can prepare a particular meal at a csot of Rupees 100. He estimates that if the menu price of the meal is x rupees, then the number of customers who will order that meal at that price in an evening is given by the function D(x) = 200 - x. Express his day revenue,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



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  $\left|x^2+y^2
ight|\leq 2$  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

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

$$egin{aligned} \mathsf{A}.\,f(x) &= egin{cases} -2x & \mathrm{If} & x \in (-\infty,\,-2] \ 4 & \mathrm{if} & x \in (-2,2] \ 2x & \mathrm{if} & x \in (2,\infty) \ 2x & \mathrm{If} & x \in (-\infty,\,-2] \ 4 & \mathrm{if} & x \in (-2,2] \ -2x & \mathrm{if} & x \in (2,\infty) \ -2x & \mathrm{If} & x \in (2,\infty) \ -2x & \mathrm{if} & x \in (-2,2] \ -2x & \mathrm{if} & x \in (-2,2] \ -2x & \mathrm{if} & x \in (2,\infty) \ \end{bmatrix} egin{aligned} \mathsf{C}.\,\,f(x) &= egin{cases} -2x & \mathrm{If} & x \in (-2,2] \ -2x & \mathrm{if} & x \in (2,\infty) \ -2x & \mathrm{if} & x \in (-\infty,\,-2] \ 2x & \mathrm{if} & x \in (-\infty,\,-2] \ 2x & \mathrm{if} & x \in (-\infty,\,-2] \ 2x & \mathrm{if} & x \in (-2,2] \ 2x & \mathrm{if} & x \in (-2,2] \ 2x & \mathrm{if} & x \in (2,\infty) \ \end{aligned}$$

#### Answer: A

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5. Let  $\mathbb R$  be the set of all real numbers. Consider the following subsets of the plane  $\mathbb R imes\mathbb R$  $S=\{(x,y):y=x+1$  and  $0< x<2\}$  and

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

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 equivalence 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'

 $\mathsf{C}.\,B$ 

Answer: D



**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

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

A. 6 B. 4 C. 8 D. 16

#### Answer: B

View Text Solution

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

A. 2<sup>3</sup> B. 3<sup>2</sup> C. 6

 $\mathsf{D.}\,5$ 

# Answer: C



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

A.  $2^{17}$ 

- $\mathsf{B}.\,17^2$
- C.34

D. insufficient data

#### Answer: B



11. For non empty set A and B if  $A \subset B$  then  $(A imes B) \cap (B imes A)$  is

equal to

A.  $A\cap B$ 

 $\mathsf{B}.\, A \times A$ 

 $\mathsf{C}.\,B\times B$ 

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

**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

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**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

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

$$\begin{array}{l} \mathsf{A.} \left( -\infty, \ -1 \right) \cup \left( \frac{1}{3}, \infty \right) \\ \mathsf{B.} \left( -1, \frac{1}{3} \right) \\ \mathsf{C.} \left[ -1, \frac{1}{3} \right] \\ \mathsf{D.} \left( -\infty, \ -1 \right] \cup \left[ \frac{1}{3}, \infty \right) \end{array}$$

#### Answer: D

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

A. [0, 1]

- $\mathsf{B}.\left[0,\infty\right)$
- C.[0,1)
- D. (0, 1)

#### Answer: C

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

 $\mathsf{C}_{\cdot}\,(,\infty),\mathbb{R}$ 

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

Answer: D
View Text Solution
<b>18.</b> 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  $f\colon [0,2\pi] o [\,-1,1]$  defined by f(x)=sin x is

A. one to one

B. onto

C. bijection

D. cannot be determined.

#### Answer: B

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

# is

 $\mathsf{A}.\,[\,-\,9,\,9]$ 

 $\mathsf{B}.\,\mathbb{R}$ 

 $\mathsf{C}.\,[\,-3,3]$ 

 $\mathsf{D}.\left[0,9
ight]$ 

#### Answer: D

**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

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22. The inverse of 
$$f(x) = \begin{cases} x & \text{if } x < 1 \\ x^2 & \text{if } 1 \le x \le 4 \text{ is} \\ 8\sqrt{x} & \text{if } x > 4 \end{cases}$$
  
A.  $f^{-1}(x) = \begin{cases} x & \text{if } x < 1 \\ \sqrt{x} & \text{if } 1 \le x \le 16 \\ \frac{x^2}{2} & \text{if } x > 16 \end{cases}$ 

 $\left( \frac{1}{64} \right)$ 

$$egin{aligned} \mathsf{B}.\,f^{-1}(x) &= egin{cases} -x & ext{if} & x < 1 \ \sqrt{x} & ext{if} & 1 \leq x \leq 16 \ rac{x^2}{64} & ext{if} & x > 16 \ x^2 & ext{if} & x < 1 \ \sqrt{x} & ext{if} & 1 \leq x \leq 16 \ rac{x^2}{64} & ext{if} & x > 16 \ rac{x^2}{64} & ext{if} & x > 16 \ rac{x^2}{64} & ext{if} & x > 16 \ rac{x^2}{64} & ext{if} & x < 1 \ \sqrt{x} & ext{if} & 1 \leq x \leq 16 \ rac{x^2}{8} & ext{if} & x > 16 \ \end{aligned}$$

#### Answer: A

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

A.  $\mathbb{R}$ 

 $B.(1,\infty)$ 

- $\mathsf{C}.\,(\,-1,\infty)$
- $\mathsf{D}.\,(\,-\infty,1]$

#### Answer: D

**24.** The function  $f\colon \mathbb{R} o \mathbb{R}$  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

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**25.** The function  $f \colon \mathbb{R} o \mathbb{R}$  is defined by

$$f(x) = rac{ig(x^2 + \cos xig)ig(1 + x^4ig)}{(x - \sin x)(2x - x^3)} + e^{-|x|}$$
 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