



MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

SETS, RELATIONS AND FUNCTIONS



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

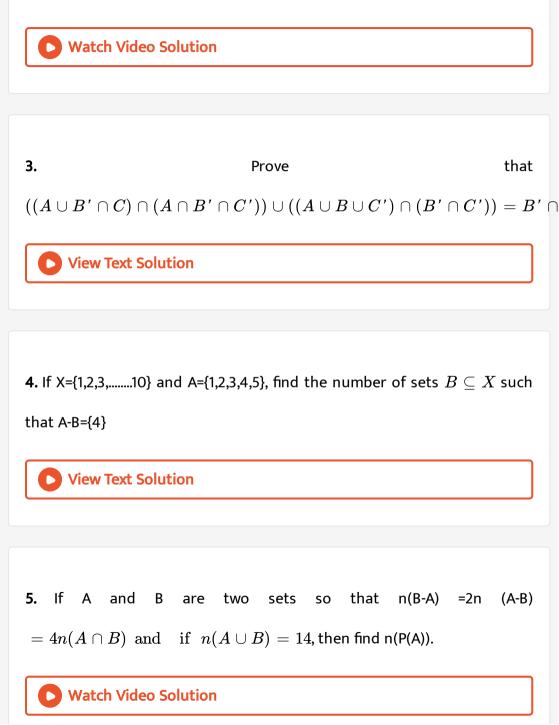
}

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

Language A and C. If 3% of the persons know and the three Languages,

find the number of persons who knows only Languages A.



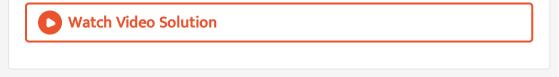
6. Two sets have m and k elements. If the total number of subsets of the first set is 112 more than that of the second set, find the values of m and k.



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

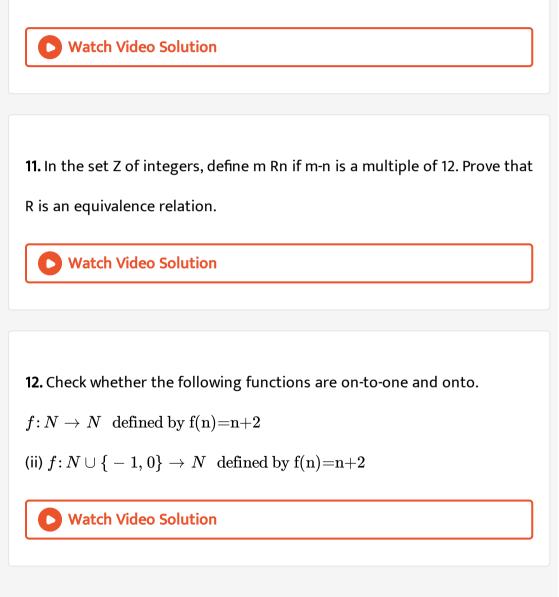
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8. If A = {1,2,3,4} and B = {3,4,5,6}, find n $((A \cup B) \times (A \cap B) \times (A \Delta B))$.



9. If P(a) denotes the Power set A and A is void set, then n(P(P(P(a)))) is:

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



13. Check whether the following functions are on-to-oneness ande ontoness.

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

(ii) $f \colon R \to R$ defined by $\mathrm{f(n)} = n^2$

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14. Check whether the following for one-to-oneness and ontoness.

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

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15. If f : R - (-1,1) \rightarrow R is defined by f(x) = $\frac{x}{x^2 - 1}$, verify whether f is one

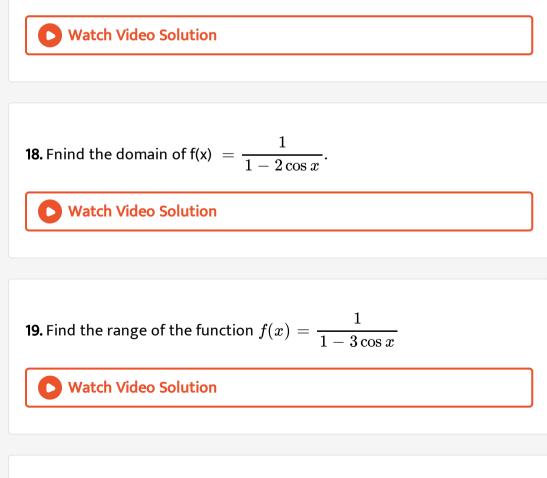
to one.

16. If $f\!:\!R o R$ is defined $\mathrm{f}(\mathrm{x})=2x^2-1$, find the pre-images of 17,4

and -2.



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



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

by
$$f(x)=rac{\sqrt{9-x^2}}{\sqrt{x^2-1}}$$

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

gof and fog.

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22. Let f={(1,4),(2,5),(3,5)} and g={(4,1),(5,2),(6,4)}. Find gof Can you find fog?

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23. Let f and g be the two functions from R to R defined by f(x)-3x-4 and $g(x) = x^2 + 3$. Find gof and fog.

24. Show that the statement, "if f and gof are one-to-one, then g is one-to-

one", is not true.



25. If $f: \mathbb{R} \to \mathbb{R}$ is defined by f (x) = 2x -3, then prove that f is a bijection

and find its inverse.

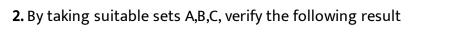
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Addtional Question Solved

1. Write the following sets in roster form

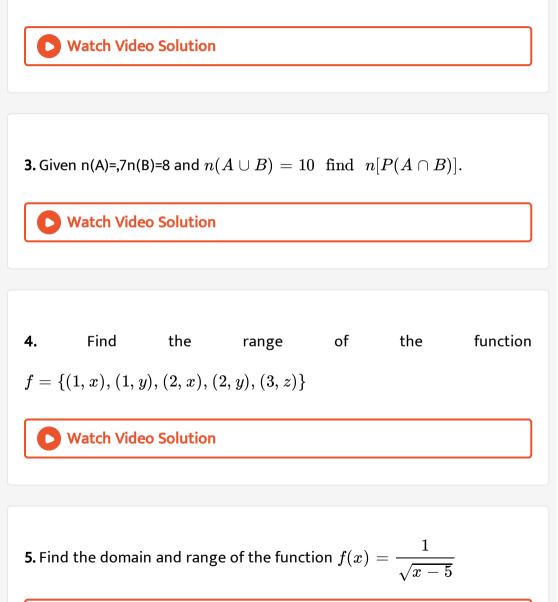
(i) $\left\{x\in N, x^3<1000
ight\}$

(ii) The set of postive roots of the equation $ig\{ig(x^2-4ig)ig(x^3-27ig)ig\}=0$



(i)
$$A imes (B \cup C) = (A imes B) \cup (A imes C)$$

(ii)
$$(B-A)\cup C=(B\cup C)-(A-C)$$



6. If
$$f(x) = rac{x-1}{x+1}, x
eq 1$$
 show that $f(f(x)) = rac{-1}{x}$ provided $x
eq 0$.

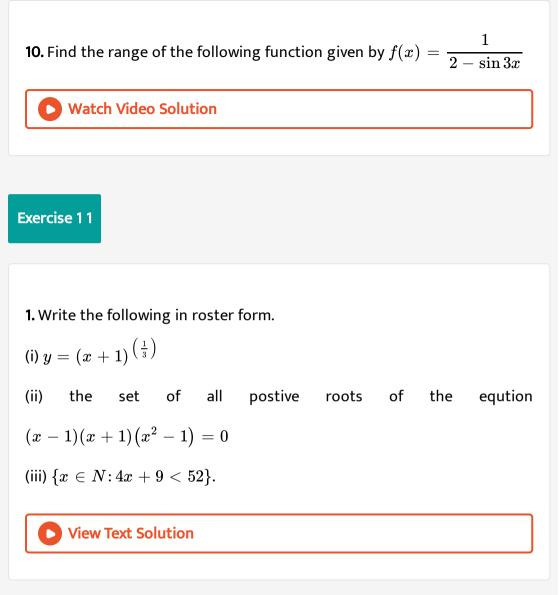


7. Find the domain of each of the following functions given by: $f(x) = rac{x^3 - x + 3}{x^2 - 1}$

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8. Find the range of the following functions given by $f(x) = 1 + 3\cos 2x$

9. Find the domain and range of the function $f(x) = rac{x^2-9}{x-3}$



2. Write the set {-1,1} in set builder form.

3. By taking suitable sets A,B,C, verify the following result :

(i)
$$A \times (B \cap C) = (A \times B) \cap (A \times C)$$
.
(ii) $A \times (B \cup C) = (A \times B) \cup (A \times C)$.
(iii) $(A \times B) \cap (B \times A) = (A \cap B) \times (B \cap A)$.
(iv) $C - (B - A) = (C \cap A) \cup (C \cap B')$.
(v) $(B - A) \cap C = (B \cap C) - A = B \cap (C - A)$.
(vi) $(B - A) \cup C = (B \cup C) - (A - C)$.

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4. Justify the trueness of the statement " An element of a set can never be

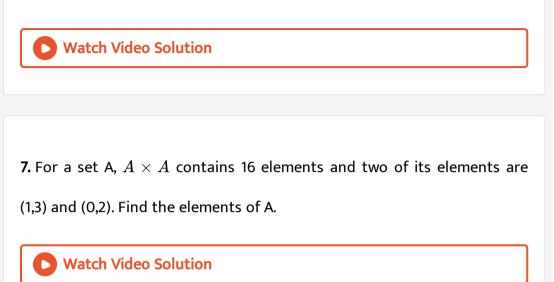
a subset of itself ".

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5. If n (p(A)) = 1024, n (A \cup B) = 15 and n (P (B)) = 32, then find n (A \cap B).



6. If $n(A \cap B) = 3$ and $n(A \cup B) = 10$ then find $n(P(A \triangle B))$



8. Let A and B be two sets 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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9. If A imes A has 16 elements, S = {(a,b) $\in A imes A : a < b$ }, (-1,2) and (0,1)

are two elements of S, then find the remaining elements of S.

1. Let X = {a, b,c,d}, 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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2. Let $X = \{a, b, c, d\}$, 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.

3. Let P be the set of all triangles in a plane and R be the relation defined on P as a Rb if a is similar to b. Prove that R is an equivalence relation .

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4. On the set of natural number let R be the relation defined by aRb if 2a
+3b=30. Write down the relation by listing all the pair . check whether it is
(i) reflexive (ii) symmetric (iii) transitive (iv) equivalence

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5. Prove that the relation " friendship " is not an equivalence relation on

the set of all people in Chennai.



6. Let A = {a,b,c }. What is the equivalence relation of smallest cardinality

on A ? What is the equivalence relation of largest cardinality on A?

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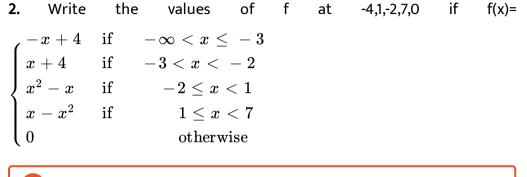
7. In the set Z of integers, define mRn if m-n is divisible by 7. Prove that R is an equivalence relation.

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Exercise 13

1. Suppose that 120 students are studying in 4 sections of eleventh standard in a school. Let A denotes 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 relation ? Explain your answer.





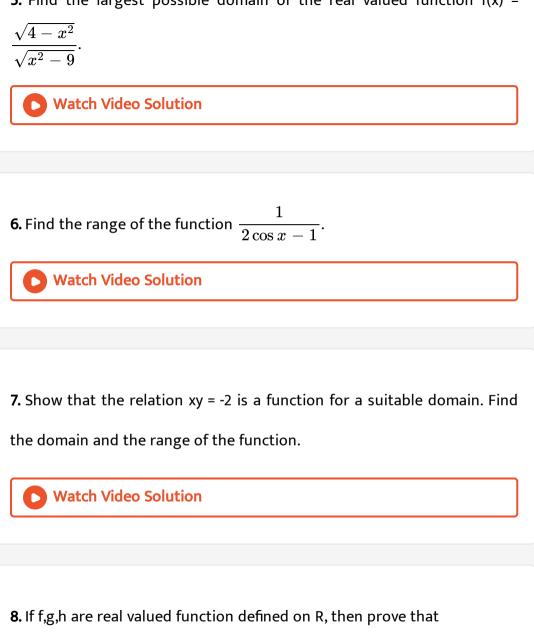
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3.	Write	the	values	of	f	at	-3,5,2,-1,0	if	f(x)=
(a	$egin{aligned} &x^2+x-5\ &x^2+3x-2\ &x^2\ &x^2-3\ \end{aligned}$	if	$x\in$	$(-\infty$	(0,0)				
Ja	$x^2 + 3x - 2$	2 if	x	$\in (3, \cdot)$	$\infty)$				
) a	c^2	if	$x\in$	(0, 2))				
la	c^2-3		otherwise	ise					

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

5. Find the largest possible domain of the real valued function f(x) =



(f+g)oh=foh+goh. what can you say about fo(g+h)? Justify your answer.

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

10. 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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11. The distance of an object falling is a function of time t and can be expressed as $s(t) = -16t^2$. Graph the function and determine if it is one-to-one.



12. The total cost of airfare on a given route is comprised of the base cost C and the fuel surcharge S in rupee. Both C and S are functions of the mileage m, C(m) =0.4 m +50 and S(m) = 0.03 m. 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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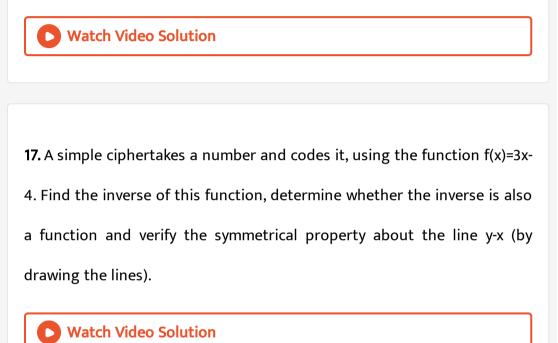
13. A salesperson whose annual earnings can be represented by the function A (x) = 30,000+0.04x, where x is the rupee value of the merchandise he sells. His son is also in sales and his earnings are represented by the function S(x) = 25,000 + 0.05 x. Find (A+S) (x) and determine the total family income if they each sell Rs 1,50,00,000 worth of merchandise.

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



15. The owner of a small restaurant can prepare a particular meal at a cost of Rupees 100. He extimate 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 a function of x.

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



Exercise 14

1. Graph the functions f (x) = x^3 and g(x) = $\sqrt[3]{x}$ on the same co-ordinate

plane. Find fog and graph it on the plane as well. Explain your results.



2. Write the steps to obtain graph of steps to obtain the graph of the

function y = 3 $(x - 1)^2$ +5 from the graph y = x^2 .



(i)
$$y = \sin(-x)$$

(ii) $y = -\sin(-x)$
(iii) $y = \sin\left(\frac{\pi}{2} + x\right)$ which is cos x
(iv) $y = \sin\left(\frac{\pi}{2} - x\right)$ which is also cos x (refer trigonometry)

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4. From the curve $y = \sin x \operatorname{draw} y = \sin |x|$ (Hint : $\sin (-x) = -\sin x$.)

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 element
- 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 xRy if $|x^2+y^2|~\leq 2$,

then which one of the following is true?

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

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

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

$$egin{aligned} \mathsf{A}.\,f(x) &= \left\{egin{aligned} &-2x & ext{if} \ x \in (\,-\infty,\,2]\ &4x & ext{if} \ x \in (\,-2,\,2]\ &2x & ext{if} \ x \in (\,-\infty,\,-2]\ &2x & ext{if} \ x \in (\,-\infty,\,2]\ &4x & ext{if} \ x \in (\,-2,\,2]\ &-2x & ext{if} \ x \in (\,2,\infty)\ &2x & ext{if} \ x \in (\,2,\infty)\ &2x & ext{if} \ x \in (2,\infty)\ &2x & ext{if} \ x & ext{if} \ x \in$$

Answer: A

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5. Let \mathbb{R} be the set of all real numbers. Consider the following subsets of the plane $\mathbb{R} \times \mathbb{R}$:S = { (x,y) : y=x+1 and 0 < x < 2} and T = { (x,y) : x-y is an integer }. Then which of the following is true ?

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

B. Neigher S nor T is an equivalence relation.

C. Both S and T are equivalence relation

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

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'

С. В

D. N

Answer: D

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

A. 1120

B. 1130

C. 1100

D. insufficient data

Answer: B

.....



8. If $n[(A \times B) \cap (B \times c) = 3$, and $n(B \cap C) = 2$ then n(A) is

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

A. 2³ B. 3² C. 6 D. 5

Answer: C

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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 date

Answer: C

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11. For non-empty sets A and B, if A $\subset B ext{then}(A imes B)\cap (B imes A)$ is equal to

A. $A\subset B$

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

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

D. None of these

Answer: B

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

B. 81

A. 9

C. 512

D. 1024

Answer: B

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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



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 $rac{1}{1-2\sin x}$ is

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

Answer: D



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

A. [0,1]

 $\mathsf{B}.\left[0,\infty\right)$

C. [0,1]

D. [0,1]

Answer: D

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

A. R,R

B. R, $(0, \infty)$

 $\mathsf{C}.\,(0,\infty),R$

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

Answer: D

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18. The number of relations form a set containing melements to a set containing n elements is

A. mm

B.m

C. n

D. m+n

Answer: C

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19. The function f : [0,2 π] ightarrow 1 [-1,1] defined by f(x) = sin x is

A. One to one

B. onto

C. Bijiection

D. Cannot to befined

Answer: B

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

A. [-9,9]

B. R

C. [-3,3]

D. [0,9]

Answer: D

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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. An function which is not one-to one

D. Not a function

Answer: D



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

A. $f^{-1}(x) = \begin{cases} x : x < 1 \\ \sqrt{x} & 1 \le x \le 16 \\ \frac{x^2}{64} : x > 16 \end{cases}$
B. $f^{-1}(x) = \begin{cases} -x : x < 1 \\ \sqrt{x} & 1 \le x \le 16 \\ \frac{x^2}{64} : x > 16 \end{cases}$
C. $f^{-1}(x) = \begin{cases} x^2 : x < 1 \\ \sqrt{x} & 1 \le x \le 16 \\ \frac{x^2}{64} : x > 16 \end{cases}$
D. $f^{-1}(x) = \begin{cases} 2x : x < 1 \\ \sqrt{x} & 1 \le x \le 16 \\ \frac{x^2}{8} : x > 16 \end{cases}$

Answer: A

23. Lett f: R o R be defined by f(x)=1-|x|. Then the range of f is

A. R

 $B.(1,\infty)$

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

D. $(-\infty,1]$

Answer: D

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24. The function f: $R \rightarrow R$ 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



25. The function R o R is defined by $f(x) = \cos x$ 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: C

