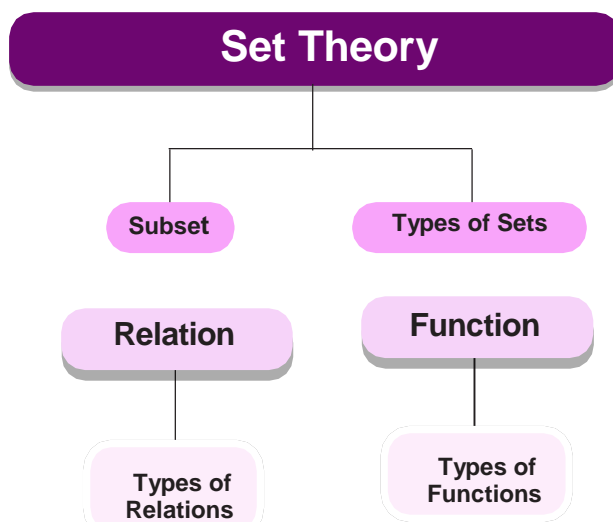


# CHAPTER - 7 SETS, RELATIONS AND FUNCTIONS



<b>SET</b>	<p>A set is defined to be a collection of well – defined distinct objects. This collection may be listed or described. Each object is called an element of the set. We usually denote sets by capital letters and their elements by small letters</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #8B4513; color: white; text-align: center;"><b>Singleton set</b></td> <td>A set containing one element is called singleton</td> </tr> <tr> <td style="background-color: #8B4513; color: white; text-align: center;"><b>Equal set</b></td> <td>Two sets A &amp; B are said to be equal, written as <math>A = B</math> if every element of A is in B and every element of B is in A.</td> </tr> </table>	<b>Singleton set</b>	A set containing one element is called singleton	<b>Equal set</b>	Two sets A & B are said to be equal, written as $A = B$ if every element of A is in B and every element of B is in A.
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<b>Equal set</b>	Two sets A & B are said to be equal, written as $A = B$ if every element of A is in B and every element of B is in A.				
<b>VENN DIAGRAMS</b>	<p>A venn diagram is a diagram that shows all possible logical relation between a fine collections of different sets. These diagram depict elements as point in the plane, and sets as region inside closed curves.</p> <div style="text-align: center;"> </div>				
<b>EQUIVALENT SET</b>	<p>Two finite sets A &amp; B are said to be equivalent if <math>n(A) = n(B)</math>.</p>				

<b>POWER SET</b>	<p>The collection of all possible subsets of a given set A is called the power set of A, to be denoted by <math>P(A)</math>.</p> <ol style="list-style-type: none"> <li>1. A set containing n elements has <math>2^n</math> subsets.</li> <li>2. A set containing n elements has <math>2^{n-1}</math> proper subsets</li> </ol>					
<b>PRODUCT SETS</b>	<table border="1"> <tr> <td style="background-color: #8B4513; color: white; text-align: center; vertical-align: middle;"><b>Ordered Pair</b></td> <td>Two elements a and b, listed in a specific pair, denoted by (a, b).</td> </tr> <tr> <td style="background-color: #8B4513; color: white; text-align: center; vertical-align: middle;"><b>Cartesian Product of sets</b></td> <td>If A and B are two non-empty sets, then the set of all ordered pairs (a, b) such that a belongs to A and b belongs to B, is called the Cartesian product of A and B, to be denoted by <math>A \times B</math>. Thus, <math>A \times B = \{(a, b) : a \in A \text{ and } b \in B\}</math> If</td> </tr> </table>	<b>Ordered Pair</b>	Two elements a and b, listed in a specific pair, denoted by (a, b).	<b>Cartesian Product of sets</b>	If A and B are two non-empty sets, then the set of all ordered pairs (a, b) such that a belongs to A and b belongs to B, is called the Cartesian product of A and B, to be denoted by $A \times B$ . Thus, $A \times B = \{(a, b) : a \in A \text{ and } b \in B\}$ If	
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<b>RELATION AND FUNCTION</b>	<p>Any subset of the product set X,Y is said to define a relation from X to Y and any relation from X to Y in which no two different ordered pairs have the same first elements is called a function.</p> <p>Let A and B be two non-empty sets. Then, a rule or a correspondence f which associates to each element x of A, a unique element, denoted by <math>f(x)</math> of B is called a function or mapping from A to B and we write <math>f : A \rightarrow B</math></p>					
<b>DOMAIN &amp; RANGE OF A FUNCTION</b>	<p>Let <math>f : A \rightarrow B</math> then, A is called the domain of f, while B is called the co-domain of f.</p> <p>The set <math>f(A) = \{f(x) : x \in A\}</math> is called the range of f.</p>					

## VARIOUS TYPES OF FUNCTION

### IDENTITY FUNCTION

• Let A be a non-empty set. Then, the function I defined by  $I : A \rightarrow A : I(x) = x$  for all  $x \in A$  is called an identity function on A

### EQUAL FUNCTION

• Two functions f and g are said to be equal, written as  $f = g$  if they have the same domain and they satisfy the condition  $f(x) = g(x)$ , for all x.

### INVERSE FUNCTION

• Let f be a one-one onto function from A to B. Let y be an arbitrary element of B. Then f being onto, there exists an element x in A such that  $f(x) = y$ . A function is invertible if and only if f is one-one onto.

**ONE -ONE FUNCTION**

•Let  $f : A \rightarrow B$ . If different elements in A have different images in B, then f is said to be a one-one or an injective function or mapping

**ONTO or SURJECTIVE FUNCTION**

•Let  $f : A \rightarrow B$ . If every element in B has at least one pre- image in A, then f is said to be an onto function. If f is onto, then corresponding to each  $y \in B$ , we must be able to find at least one element  $x \in A$  such that  $y = f(x)$  Clearly, f is onto if and only if range of  $f = B$

**BIJECTION FUNCTION**

•A one-one and onto function is said to be bijective

**Different types of relations**

Let  $S = \{a, b, c, \dots\}$  be any set then the relation R is a subset of the product set  $S \times S$

i) If R contains all ordered pairs of the form  $(a, a)$  in  $S \times S$ , then R is called reflexive. In are *flexile* relation 'a' is related to itself.

For example, 'Is equal to' is a reflexive relation for  $a = a$  is true.

ii) If  $(a, b) \in R \Rightarrow (b, a) \in R$  for every  $a, b \in S$  then R is called symmetric

For Example,  $a = b \Rightarrow b = a$ . Hence the relation 'is equal to' is a symmetric relation.

iii) If  $(a, b) \in R$  and  $(b, c) \in R \Rightarrow (a, c) \in R$  for every  $a, b, c \in S$  then R is called transitive.

For Example  $a = b, b = c, a = c$ . Hence the relation 'is equal to' is a transitive relation.

A relation which is reflexive, symmetric and transitive is called an *equivalence relation* or simply equivalence. 'is equal to' is an equivalence relation.

Similarly, the relation "is parallel to" on the set S of all straight lines in a plane is an equivalence relation.

**Domain & Range of a relation**

If R is a relation from A to B, then the set of all first co- ordinates of elements of R is called the domain of R, while these to fall second co-ordinates of elements of R is called the range of R.



**Question1**

**Which of the following statements is used to create an empty set?**

- (a)  $\{\}$
- (b) Set  $()$
- (c)  $[\ ]$
- (d)  $( )$

**Answer: b**

**Explanation:**

$\{\}$  Creates a dictionary not a set. Only set  $()$  creates an empty set.

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**Question 2**

**What is the output of the following piece of code when executed in the python shell?**

- (a) { 2, 3} (b) Error, duplicate item present in list  
 (c) Error, no method called intersection update for set data type (d) { 1, 4, 5 }

**Answer: a**

**Explanation:**

The method intersection update returns a set which is an intersection of both the sets.

**Question 3**

**Which of the following lines code will result is an error?**

- (a) {abs} (b) s = {4, 'abc', (1,2) }  
 (c) { 1, 2, 5, 9} (d) {1, 5, 7, 9, 11}

**Answer: d**

**Explanation:**

The line: s={san} will result is an error because 'san' is not defined. The line s={abs} does not result in an error because abs is a built – in function. The other sets shown do not result in an error because all the items are hashable.

**Question 4**

**What is the output of the code shown below?**

**S=set ([1, 2, 3,])**

**S, union ([4, 5])**

**S|([4, 5])**

- (a) {1, 2, 3, 4, 5} {1, 2, 3, 4, 5} (b) Error {1, 2, 3, 4, 5}  
 (c) {1, 2, 3, 4, 5} Error (d) Error

**Answer: c**

**Explanation:**

The first function in the code shown above returns the set { 1, 2, 3, 4, 5}. This is because the method of the function union allows any alterable. However, the second function results in an error because f unsupported data type that is list and set.

**Question 5**

**What is the output of the line of code shown below, if s1 = {1, 2, 3} Is S1 subset ?**

- (a) True (b) Error  
 (c) No output (d) Proposition

**Answer: a**

**Explanation:**

Every set is a subset of itself and hence the output of this line of code is true.

**Question 6**

**A \_\_\_\_ is an ordered collection of objects.**

- (a) Relation (b) Function  
 (c) Set (d) Proposition

**Answer: c**

**Explanation:**

A set is an ordered collection of objects.

**Question 7**

**The set of odd positive integers less than 10 can be expressed by \_\_\_\_\_**

- (a) {1, 2, 3} (b) {1, 3, 5, 7, 9}  
 (c) {1, 2, 5, 9} (d) {1, 5, 7, 9, 11}

**Answer: b**

**Explanation:**

Odd numbers less than 10 is {1, 3, 5, 7, 9}.

**Question 8**

**Power set of empty set has exactly \_\_\_\_\_ subset.**

- (a) 1 (b) 2  
 (c) 0 (d) 3

**Answer: a**

**Explanation:**

Power set of null set has exactly one subset which is empty set.

**Question 9**

**What is the Cartesian product of  $A = \{1, 2\}$  and  $B = \{a, b\}$ ?**

- (a) {(1, a), (1, b), (2, a), (b, b)} (b) {(1, 1), (2, 2), (a, a), (b, b)}  
 (c) {(1, a), (2, a), (1, b), (2, b)} (d) {(1, 1), (a, a), (2, a), (1, b)}

**Answer: c**

**Explanation:**

A subset R of the Cartesian Product  $A \times B$  is a relation from the set A to the set B.

**Question 10**

**The Cartesian product  $B \times A$  is equal to the Cartesian product  $A \times B$ . Is it True or False?**

- (a) True (b) False  
 (c) partial true (d) not sure

**Answer: b**

**Explanation:**

Let  $A = \{1, 2\}$  and  $B = \{a, b\}$ . The Cartesian product  $A \times B = \{(1, a), (1, b), (2, a), (2, b)\}$  and the Cartesian product  $B \times A = \{(a, 1), (a, 2), (b, 1), (b, 2)\}$ . This is not equal to  $A \times B$

**Question 11**

**What is the cardinality of the set of odd positive integers less than 10?**

- (a) 10 (b) 5  
 (c) 3 (d) 20

**Answer: b**

**Explanation:**

Set S of odd positive an odd integer less than 10 is {1, 3, 5, 7, 9}. Then Cardinality of set S = |S| which is 5.

**Question 12**

**Which of the following two sets are equal?**

- (a)  $A = \{1, 2\}$  and  $B = \{1\}$  (b)  $A = \{1, 2\}$  and  $B = \{1, 2, 3\}$

(c)  $A = \{1, 2, 3\}$  and  $B = \{2, 1, 3\}$ (d)  $A = \{1, 2, 4\}$  and  $B = \{1, 2, 3\}$ **Answer: c****Explanation:**

Two set are equal if and only if they have the same elements.

**Question13****The set of positive integers is \_\_\_\_\_ -**

(a) Infinite

(b) Finite

(c) Subset

(d) Empty

**Answer: a****Explanation:**

The set of positive integers is not finite

**Question 14****What is the Cardinality of the power set of the set  $\{0, 1, 2\}$ .**

(a) 8

(b) 6

(c) 7

(d) 9

**Answer: a****Explanation:**Power set  $P(\{0, 1, 2\})$  is the set of all subsets of  $\{0, 1, 2\}$ . Hence,  $P(\{0, 1, 2\}) = \{\text{null}, \{0\}, \{1\}, \{2\}, \{0, 1\}, \{0, 2\}, \{0, 1, 2\}\}$ .**Question15****The members of the set  $S = \{x|x \text{ is the square of an integer and } x < 100\}$  is \_\_\_\_\_**(a)  $\{0, 2, 4, 5, 9, 58, 49, 56, 99, 12\}$ (b)  $\{0, 1, 4, 9, 16, 25, 36, 49, 64, 81\}$ (c)  $\{1, 4, 9, 16, 25, 36, 64, 81, 85, 99\}$ (d)  $\{0, 1, 4, 9, 16, 25, 36, 49, 64, 121\}$ **Answer: b****Explanation:**

The set S consist of the square of an integer less than 10.

**Question16****Let the set A is the  $\{1, 2, 3\}$  and B is  $\{2, 3, 4\}$ . Then number of elements in  $A \cup B$  is**

(a) 4

(b) 5

(c) 6

(d) 7

**Answer: a****Explanation:** $A \cup B$  is  $\{1, 2, 3, 4\}$ **Question 17**Let the set A is  $\{1, 2, 3\}$  and B is  $\{2, 3, 4\}$ . Then number of elements in  $A \cap B$  is

(a) 1

(b) 2

(c) 3

(d) 4

**Answer: b****Explanation:** $A \cap B$  is  $\{2, 3\}$ **Question 18****Let the set A is  $\{1, 2, 3\}$  and B is  $\{2, 3, 4\}$ . Then the set  $A - B$  is**(a)  $\{1, -4\}$ (b)  $\{1, 2, 3\}$

(C) {1}

(d) {2, 3}

**Answer: c****Explanation:**In  $A - B$  the common elements get cancelled.**Question 19****In which of the following sets  $A - B$  is equal to  $B - A$** (a)  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 4\}$ (b)  $A = \{1, 2, 3\}$ ,  $B = \{1, 2, 3, 4\}$ (C)  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 1\}$ (d)  $A = \{1, 2, 3, 4, 5, 6\}$ ,  $B = \{2, 3, 4, 5, 1\}$ **Answer: c****Explanation:** $A - B = B - A = \text{Empty set.}$ **Question 20****Let  $A$  be set of all prime numbers;  $B$  be the set of all even prime numbers.  $C$  be the set of all odd prime numbers, then which of the following is true?**(a)  $A = B \cup C$ (b)  $B$  is a single on set(c)  $A = C \cup \{2\}$ 

(d) All of the mentioned

**Answer: d****Explanation:**

2 is the only even prime number.

**Question 21****If  $A$  has 4 elements  $B$  has 8 elements, then the minimum and maximum number of elements in  $A \cup B$  are respectively**

(a) 4, 8

(b) 8, 12

(C) 4, 12

(d) None of the mentioned

**Answer: b****Explanation:**

Minimum would be when 4 elements are same as in 8, maximum would be when all are distinct.

**Question 22****If  $A$  is  $\{\{\Phi\}, \{\Phi, \{\Phi\}\}$ , then the power set of  $A$  has how many elements?**

(a) 2

(b) 4

(c) 6

(d) 8

**Answer: b****Explanation:**The set  $A$  has got 2 elements so  $n(P(A)) = 4$ .**Question 23****Two sets  $A$  and  $B$  contains  $a$  and  $b$  elements respectively. If power set of  $A$  contains 16 more elements than that of  $B$ , value of ' $b$ ' and ' $a$ ' are respectively**

(a) 5, 4

(b) 6, 7

(c) 2, 3

(d) None of the mentioned

**Answer: a****Explanation:** $2^a - 2^b = 16$ , hence  $a=5$ ,  $b=4$

**Question 24**

Let A be {1, 2, 3, 4}, U be set of all natural numbers, then  $U - A'$  (complement of A) is given by set.

- (a) {1, 2, 3, 4, 5, 6, .....} (b) {5, 6, 7, 8, 9, .....}  
 (c) {1, 2, 3, 4} (d) All of the mentioned

**Answer: c**

**Explanation:**

$$U - A' = A.$$

**Question 25**

Which sets are not empty?

- (a) {x:x is a even prime greater than 3} (b) {x:x is a multiple of 2 and is odd}  
 (c) {x:x is an even number and x+3 is even} (d) {x:x is a prime number is less than 5 and is odd}

**Answer: d**

**Explanation:**

Because the set is {3}

**Question 26**

If A, B and C are any three sets, then  $A - (B \cap C)$  is equal to

- (a)  $(A - B) \cup (A - C)$  (b)  $(A - B) \cap (A - C)$   
 (c)  $(A - B) \cup C$  (d) None

**Answer: a**

**Explanation:**

From De Morgan's Law,  $A - (B \cap C) = (A - B) \cup (A - C)$

**Question 27**

Which of the following is the empty set?

- (a) {x:x is a real number and  $x^2 - 1 = 0$ } (b) {x:x is a real number and  $x^2 + 1 = 0$ }  
 (c) {x : x is a real number and  $x^2 - 9 = 0$ } (d) {x : x is a real number and  $x^2 = x + 2$ }

**Answer: d**

**Explanation:**

Since  $x^2 - 1 = 0$ , given  $x^2 = 1$

$$x = \pm 1$$

$\therefore$  No value of x is possible

**Question 28**

If a set A has n elements, then the total number of subsets of A is

- (a) n (b)  $n^2$   
 (c)  $2^n$  (d) 2n

**Answer: c**

**Explanation:**

Number of subsets of A =  $n_{c_0} + n_{c_1} + \dots + n_{c_n} = 2^n$

**Question 29**

If A and B are any two sets, then  $A \cup (A \cap B)$  is equal to

- (a) A (b) B  
 (c)  $A^c$  (d)  $B^c$

**Answer: a**



**Explanation:**

$$A \cap B \subseteq A$$

$$\text{Hence } A \cup (A \cap B) = A$$

**Question 30**

If two sets A and B are having 99 elements in common, then the number of elements common to each of the sets  $A \times B$  and  $B \times A$  are

- (a)  $2^{99}$  (b)  $99^2$   
 (c) 100 (d) 18

**Answer: b****Explanation:**

$$n((A \times B) \cap (B \times A))$$

$$= n((A \cap B) \times (B \cap A)) = n(A \cap B) \cdot n(B \cap A)$$

$$= n(A \cap B) \cdot n(A \cap B) = (99)(99) = 99^2$$

**Question 31**

If  $A = \{x : x \text{ is a multiple of } 4\}$  and  $B = \{x : x \text{ is a multiple of } 6\}$  then  $A \cap B$  consists of all multiples of?

- (a) 16 (b) 12  
 (c) 8 (d) 4

**Answer: b****Explanation:**

$$A = \{4, 8, 12, 16, 20, 24, \dots\}$$

$$B = \{6, 12, 18, 24, 30, \dots\} \setminus A \cap B = \{12, 24, \dots\}$$

$$= \{x : x \text{ is a multiple of } 12\}.$$

**Question 32**

If  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{2, 4, 6\}$ ,  $C = \{3, 4, 6\}$ , Then  $(A \cup B) \cap C$  is

- (a)  $\{3, 4, 6\}$  (b)  $\{1, 2, 3\}$   
 (c)  $\{1, 4, 3\}$  (d) None of these

**Answer: a****Explanation:**

$$A \cup B = \{1, 2, 3, 4, 5, 6\} \setminus (A \cup B) \cap C = \{3, 4, 6\}$$

**Question 33**

If  $n(A) = 4$ ,  $n(B) = 3$ ,  $n(A \times B \times C) = 24$ , then  $n(C) =$

- (a) 288 (b) 1  
 (c) 2 (d) 17

**Answer: c****Explanation:**

$$n(A) = 4, n(B) = 3 \Rightarrow n(A) \times n(B) \times n(C) = n(A \times B \times C) \Rightarrow 4 \times 3 \times n(C) = 24$$

$$n(C) = \frac{24}{12} = 2$$

**Question 34**

If  $A = \{2, 3, 5\}$ ,  $B = \{2, 5, 6\}$ , then  $(A - B) \times (A \cap B)$  is

- (a)  $\{(3, 2), (3, 3), (3, 5)\}$  (b)  $\{(3, 2), (3, 5), (3, 6)\}$

(c)  $\{(3, 2), (3, 5)\}$ 

(d) None of these

**Answer: c****Explanation:**

$$A - B = \{3\}, A \cap B = \{2, 5\}$$

$$(A - B) \times (A \cap B) = \{(3, 2); (3, 5)\}$$

**Question 35****The set of intelligent students in a class is [AMU 1998]**

(a) A null set

(b) A singleton set

(c) A finite set

(d) Not a well definite collection

**Answer: d****Explanation:**

Since, intelligence is not defined for students in a class i.e. Not a well defined collection.

**Question 36****If A and B be any two sets, then  $(A \cap B)'$  is equal to**(a)  $A' \cap B'$ (b)  $A' \cup B'$ (c)  $A \cap B$ (d)  $A \cup B$ **Answer: b****Explanation:**From De' Morgan's Law,  $(A \cap B)' = A' \cup B'$ **Question 37****In a class of 100 students, 55 students have passed in Mathematics and 67 students have passed in physics. Then the number of students who have passed in Physics only is**

(a) 22

(b) 33

(c) 10

(d) 45

**Answer: d****Explanation:**

$$n(M) = 55, n(P) = 67, n(M \cup P) = 100 \text{ Now,}$$

$$n(M \cup P) = n(M) + n(P) - n(M \cap P)$$

$$100 = 55 + 67 - n(M \cap P) \Rightarrow n(M \cap P) = 122 - 100 = 22$$

$$\text{Now } n(P \text{ only}) = n(P) - n(M \cap P) = 67 - 22 = 45$$

**Question 38****20 teachers of a school either teach mathematics or physics. 12 of them teach mathematics while 4 teach both the subjects. Then the number of teachers teaching physics only is**

(a) 12

(b) 8

(c) 16

(d) None of these

**Answer: a****Explanation:**

$$\text{Let } n(P) = \text{Number of teachers in Physics. } n(M)$$

$$= \text{Number of teachers in Math's } n(P \cup M) = n(P) + n(M) - n(P \cap M)$$

$$20 = n(P) + 12 - 4$$

$$= n(P) = 12$$

**Question 39**

In a battle 70% of the combatants lost one eye, 80% an ear, 75% an arm, 85% a leg, x% lost all the four limbs. The maximum value of x is

- (a) 10 (b) 12  
(c) 15 (d) None of these

**Answer: a**

**Explanation:**

Minimum value of  $1+ba > 0$   
 $= 100 - 90 = 10$

**Question 40**

If A and B are not disjoint sets, then  $n(A \cup B)$  is equal to? [Kerala (Eng.) 2001]

- (a)  $n(A)+n(B)$  (b)  $n(A)+n(B)-n(A \cap B)$   
(c)  $n(A)+n(B)+n(A \cap B)$  (d)  $n(A)n(B)n(A)-n(B)$

**Answer: b**

**Explanation:**

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

**Question 41**

Let A and B be two sets such that  $n(A)=0.16$ ,  $n(B)=0.14$ ,  $n(A \cup B)=0.25$ . Then  $n(A \cap B)$  is equal to

- (a) 0.3 (b) 0.5  
(c) 0.05 (d) None of these

**Answer: c**

**Explanation:**

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$   
 $0.25 = 0.16 + 0.14 - n(A \cap B)$   
 $n(A \cap B) = 0.30 - 0.25 = 0.05$

**Question 42**

Let A and B be two sets then  $(A \cup B)' \cup (A' \cap B)$  is equal to

- (a)  $A'$  (b) A  
(c)  $B'$  (d) None of these

**Answer: a**

**Explanation:**

From Venn-Euler's Diagram  
 $\therefore (A \cup B)' \cup (A' \cap B) = A'$

**Question 43**

If A and B are two sets then  $(A - B) \cup (B - A) \cup (A \cap B)$  is equal to

- (a)  $A \cup B$  (b)  $A \cap B$   
(c) A (d)  $B'$

**Answer: a**

**Explanation:**

From Venn-Euler's diagram  
 $\therefore (A - B) \cup (B - A) \cup (A \cap B)$

**Question: 44**

The shaded region in the given figure is:

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(a)  $A \cap (B \cup C)$

(b)  $A \cup (B \cap C)$

(c)  $A \cap (B - C)$

(d)  $A - (B \cup C)$

**Answer: d****Explanation:**From Venn-Euler's diagram,  $A - (B \cup C)$ **Question45****If A and B are two sets, then  $A \cup B = A \cap B$** 

(a)  $A \times B$

(b)  $B + A$

(c)  $A = B$

(d) None of these

**Answer: c****Explanation:**Let  $X \in A \rightarrow X \in A \cup B$ , [ $\therefore A \subseteq A \cup B$ ] $= X \in A \cap B$ , [ $\therefore A \cup B = A \cap B$ ] $= X \in A$  and  $X \in B$  $P \times \in B, \setminus A \subseteq B$ Similarly  $X \in B$  $= X \in A \setminus B \subseteq A$  Now  $A \subseteq B, B \subseteq A$  $= A = B$ **Question 46****The number of non-empty subsets of the set {1, 2, 3, 4} is**

(a) 15

(b) 14

(c) 16

(d) 17

**Answer: a****Explanation:**The number of non - empty subsets =  $2^n - 1$ 

$2^4 - 1 = 16 - 1 = 15$

**Question47****Which set is the subset of all given sets**

(a) {1, 2, 3, 4, .....}

(b) {1}

(c) {0}

(d) {}

**Answer: d****Explanation:**

Null set is the subset of all given sets.

**Question 48** **$A = \{x: x \neq x\}$  represents**

(a) {0}

(b) {}

(c) {1}

(d) {x}

**Answer: b****Explanation:**

It is fundamental concept.

**Question 49****If  $A = \{2, 4, 5\}$ ,  $B = \{7, 8, 9\}$ , then  $n(A \times B)$  is equal to**

(a) 6

(b) 9

(c) 3

(d) 0

**Answer: b****Explanation:**

$$A \times B = \{(2, 7), (2, 8), (2, 9), (4, 7), (4, 8), (4, 9), (5, 7), (5, 8), (5, 9)\} \quad n(A \times B) = n$$

$$n = 3 \times 3 = 9.$$

**Question 50**

**In a city 20 percent of the population travels by car, 50 percent travels by bus and 10 percent travels by both car and bus. Then persons travelling by car or bus are**

- (a) 80 percent (b) 40 percent  
(c) 60 percent (d) 70 percent

**Answer: c****Explanation:**

Given that,  $n(C) = 20\%$ ,  $n(B) = 50\%$ ,  $n(C \cap B) = 10\%$

Population who travel by car or bus is represented by  $n(C \cup B)$

We know that,  $n(C \cup B) = n(C) + n(B) - n(C \cap B)$

$$= 20\% + 50\% - 10\%$$

$$= 60\%$$

Hence 60% of the population travel by car or bus.

**Question 51**

**At a certain conference of 100 people there are 29 Indian women and 23 Indian men, out of these Indian people 4 are doctors and 24 are either men or doctor. There are no foreign doctors. The numbers of women doctors attending the conference is:**

- (a) 2 (b) 4  
(c) 1 (d) None of these

**Answer: c****Explanation:**

Let, M = Indian men, W = Indian women, D = Indian doctors.

According to question,  $n(M \cup D) = 24$ ,  $n(M) = 23$ ,  $n(W) = 29$ ,  $n(D) = 4$ .

As per the set rule,  $n(M \cup D) = n(M) + n(D) - n(M \cap D)$ . This implies,  $n(M \cap D) = 3$ .

Since, three men are doctors, therefore, number of women doctors =  $4 - 3 = 1$

**Question 52**

**The minimum value of the function  $f(x) = x^2 - 6x + 10$  is:**

- (a) 1 (b) 2  
(c) 3 (d) 10

**Answer: a****Explanation:**

$$F(x) = x^2 - 6x + 10$$

$$F(x) = 2x - 6$$

$$F(x) = 0 \rightarrow 2x = 6 \rightarrow x = 3$$

$$F(3) = 3^2 - 6 \times 3 + 10 = 9 - 18 + 10 = 1$$

**Question 53**

**If  $f(x) = x^3 + \frac{1}{x^4}$  then value of  $f(x) - f(1/x)$  is equal to**

- (a) 0 (b) 1  
(c)  $x^3 + \frac{1}{x^4}$  (d) None of these

**Answer: a**

**Explanation:**

$$x^3 + \frac{1}{x^4} - \frac{1}{x^3} + x^4$$

$$\frac{x^3}{x^3} + \frac{x^4}{x^4}$$

$$-1+1 = 0$$

**Question 54**

The relation "Is parallel to" over the set of straight line in a given plane is:

- (a) Reflexive (b) Symmetric  
(c) Transitive (d) Equivalence Relation

**Answer: d****Explanation:**

Equivalent relation: An equivalent relation on a set S, is a relation on S which is reflexive, symmetric and transitive. Example: Let S = Z and define R = {(x, y) x and y have the same parity} i.e. x and y are either both even or both odd.

**PREPARE FOR WORST****Question 1**

If A = [(x, y): x<sup>2</sup> + y<sup>2</sup> = 25] and B = [(x, y) : x<sup>2</sup> + 9y<sup>2</sup> = 144], then A ∩ B contains \_\_\_\_\_ points.

- (a) 6 (b) 8  
(c) 16 (d) 4

**Question 2**

In a college of 300 students, every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers is

- (a) 25 (b) 18  
(c) 16 (d) 78

**Question 3**

If  $f(x) = \frac{x-3}{x+1}$ , then  $f[f(f(x))]$  equals \_\_\_\_ .

- (a)  $f\left(\frac{[3+x]}{[1-x]}\right)$  (b)  $f\left(\frac{[89+x]}{[1-x]}\right)$   
(c)  $f\left(\frac{[3-x]}{[1-x]}\right)$  (d) none

**Question 4**

Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = 2x + |x|$ , then  $f(2x) + f(-x) - f(x) = \underline{\hspace{2cm}}$ .

- (a) 4x (b) 2|x|  
(c) 3|x| (d) none

**Question 5**

If  $f(x) = \frac{x^2-1}{x^2+1}$ , for every real number. Then what is the minimum value of f?

- (a) 1 (b) 2  
(c) 3 (d) 4

**Question 6**

The Cartesian product A × A has 9 elements among which are found (-1, 0) and (0, 1). Find the set A and the remaining elements of A × A.

- (a)  $(-1, -1), (-1, 1), (0, -1), (0, 0), (1, -1), (1, 0)$  and  $(1, 1)$   
 (c) Neither a or b
- (b)  $(-1, 1), (1, 1), (0, -1), (0, 0), (1, -1), (1, -1)$  and  $(1, 1)$ .  
 (d) can't Justify

**Question 7**

Express the function  $f: A \rightarrow R$ .  $f(x) = x^2 - 1$ . Where  $A = \{-4, 0, 1, 4\}$  as a set of ordered pairs.

- (a)  $\{(-4, 15), (0, -1), (1, 0), (4, 15)\}$   
 (c) Neither a or b
- (b)  $(-1, 1), (1, 1), (0, -1), (0, 0), (1, -1), (1, -1)$  and  $(1, 1)$ .  
 (d)  $\{(4, 15), (1, 1), (1, 0), (4, -15)\}$

**Question 8**

Assume that  $A = \{1, 2, 3 \dots 14\}$ . Define a relation  $R$  from  $A$  to  $A$  by  $R = \{(x, y): 3x - y = 0, \text{ such that } x, y \in A\}$ . Determine and write down its range, domain, and codomain.

**Question 9**

If  $R = \{(a, a^3): a \text{ is a prime number less than } 5\}$  is a relation. Find the Range of  $R$ .

- (a)  $\{8, 27\}$   
 (c) Neither a or b
- (b)  $\{-8, 27\}$   
 (d) Both a & b

**Question 10**

If  $R = \{(x, y): x + 2y = 8\}$  is a relation on  $N$ , then write the range of  $R$ .

- (a)  $\{8, 2, 7\}$   
 (c) Neither a or b
- (b)  $\{3, 2, 1\}$   
 (d) Both a & b

**Question 11**

If  $A = \{1, 2, 3\}$ ;  $B = \{4, 5, 6, 7\}$  and  $f = \{(1, 4), (2, 5), (3, 6)\}$  is a function from  $A$  to  $B$ . State whether  $f$  is one-one or not

- (a) One - One  
 (C) One to Many
- (b) One- Two  
 (d) Many to One

ANSWERS AVAILABLE ON:

- TELEGRAM CHANNEL: [t.me/KINSHUKInstitute](https://t.me/KINSHUKInstitute)
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## PAST EXAMINATION QUESTIONS:

### MAY 2018

**Question 1**

Let  $N$  be the set of all natural numbers;  $E$  be the set of all even natural numbers then the function

$f: N \rightarrow E$  defined as  $f(x) = 2x - \forall x \in N$  is =

- (a) One-one-into  
 (c) One-one onto
- (b) Many-one-into  
 (d) Many-one-onto

**Answer: c****Given**

$$N = \{1, 2, 3, 5, 6, \dots, \infty\}$$

$$E = \{2, 4, 6, 8, \dots, \infty\}$$

$$F: N \rightarrow E$$

$$f(x) = 2x - V \times EN$$

$$F(x) = -2x$$

$$F(1) = 2 \times 1 = 2$$

$$F(2) = 2 \times 2 = 4$$

$$F(3) = 2 \times 3 = 6$$

$$\text{Range of function} = \{2, 4, 6, \dots\} = E$$

$$\text{And } f(X1) = f(X2)$$

$$2 \times 1 = 2 \times 2 = X2$$

So  $f(x)$  function is one-one and onto.

**Question 2**

**In a town of 20,000 families it was found that 40% families buy newspaper. A<sub>1</sub> 20% families buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and A and C if 2% families buy all the three newspapers, then the number of families which by A only is :**

(a) 6600

(b) 6300

(c) 5600

(d) 600

**Answer: a****Explanation:**

$$\text{Total Families } n(u) = 20000$$

$$\text{No. of families who buy Newspapers 'A' } n(A) = 40\% \text{ of } 20000 = 8000$$

$$\text{No. of families who buy Newspapers 'B' } n(B) = 20\% \text{ OF } 2000 = 4000$$

$$\text{No. of families who buy Newspapers 'C'}$$

$$n(C) = 10\% \text{ of } 20000 = 2000$$

$$\text{No. of families who buy Newspapers A \& B}$$

$$n(A \cap B) = 5\% \text{ OF } 20000 = 1000$$

$$\text{No. of families who buy Newspapers B \& C}$$

$$n(B \cap C) = 3\% \text{ OF } 20000 = 600$$

$$\text{No. of families who buy Newspapers C \& A}$$

$$n(C \cap A) = 4\% \text{ OF } 20000 = 800$$

$$\text{No. of families who buy all Newspapers } n(A \cap B \cap C) = 2\% \text{ OF } 20000 = 400$$

$$\text{No. of families who buy Newspapers 'A' only}$$

$$= n(A \cap B \cap C)$$

$$= n(A) - n(A \cap B) - n(A \cap C) + n(n B \cap C)$$

$$= 8000 - 1000 - 800 + 400$$

$$= 6600$$

**Question 3**

**The numbers of proper sub set of the set {3, 4, 5, 6, and 7} is:**

(a) 32

(b) 31

(c) 30

(d) 25

**Answer: b**

$$A = \{3, 4, 5, 6, 7\}$$

$$n(A)' = 5$$





If  $A = \{1, 2, 3, 4, 5, 6, 7\}$  and  $B = \{2, 4, 6, 8\}$ . Cardinal member of  $A - B$  is:

- (a) 4 (b) 3  
(c) 9 (d) 7

**Answer: a**

**Explanation:**

$$A = \{1, 2, 3, 4, 5, 6, 7\}$$

$$B = \{2, 4, 6, 8\}$$

$$A - B = \{1, 2, 3, 4, 5, 6, 7\} - \{2, 4, 6, 8\}$$

$$= \{1, 3, 5, 7\}$$

$$n(A - B) = 4$$

#### Question 4

Identify the function from the following:

- (a)  $\{(1,1), (1,2), (1,3)\}$  (b)  $\{(1, 1), (2, 1), (2, 3)\}$   
(c)  $\{(1, 2), (2,2), (3,2), (4,2)\}$  (d) None of these

**Answer: c**

**Explanation:**

$\{(1, 2), (2,2), (3,2), (4,2)\}$  is the function

Many one function

## MAY 2019

#### Question 1

If  $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$B = \{1, 3, 5, 7, 8\}$ ;  $C = \{2, 6, 8\}$  then find  $= (A - B) \cup C$

- (a)  $\{2, 6\}$  (b)  $\{2, 6, 8\}$   
(c)  $\{2, 6, 8, 9\}$  (d) None of these

**Answer: c**

**Explanation:**

$$A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

$$B = \{1, 3, 4, 5, 7, 8\}$$

$$C = \{2, 6, 8\}$$

$$A - B = \{2, 6, 9\}$$

$$(A - B) \cup C = \{2, 6, 8, 9\}$$

#### Question 2

If  $(x) = x^2$  and  $x=g(x) \sqrt{x}$  then

- (a)  $g \circ f(3) = 3$  (b)  $g \circ f(-3) = 9$   
(c)  $g \circ f(9) = 3$  (d)  $g \circ f(-9) = 3$

**Answer: a**

**Explanation:**

$$g \circ f = g(f(x)) = \sqrt{x^2}$$

$$g \circ f = x \quad \dots \dots \dots (1)$$

Put this equations in above objectives

Option first:

$$g \circ f(3) = 3$$

Hence option 1 is correct

**Question 3**

$A = \{1, 2, 3, 4, \dots, 10\}$  a relation on  $A$ ,  $R = \left\{ \frac{(x,y)}{x+y} = 10, x \in A, y \in A, X \geq Y \right\}$  then Domain of  $R^{-1}$  is

- (a)  $\{1, 2, 3, 4, 5\}$  (b)  $\{0, 3, 5, 7, 9\}$   
 (c)  $\{1, 2, 4, 5, 6, 7\}$  (d) None of these

**Answer: a****Explanation:** $\{1, 2, 3, 4, 5\}$ **Question 4**

If  $A = \{a, b, c, d\}$ ;  $B = \{p, q, r, s\}$  which of the following relation is a function from  $A$  to  $B$

- (a)  $R_1 = \{(a, p), (b, q), (c, s)\}$  (b)  $R_2 = \{(p, a), (b, r), (d, s)\}$   
 (c)  $R_3 = \{(b, p), (c, s), (b, r)\}$  (d)  $R_4 = \{(a, p)(b, r)(c, q), (d, s)\}$

**Answer: d****Explanation:**

Unique mapping: A map is way of associating unique objects to every element in a given set. So a map from to is a function such that for every, there is a unique object. The terms function and mapping are synonymous for map.

**NOV 2019****Question 1** $(A^T)^T = ?$ 

- (a)  $A$  (b)  $A^T$   
 (c)  $A^T \cdot A^T$  (d)  $A^{2T}$

**Answer: a****Explanation:**(a)  $(A^T)^T = A$ Example  $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ 

$$A^T = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$$

$$(A^T)^T = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = A$$

So,  $(A^T)^T = A$ **Question 2**

$F(n) = f(n-1) + f(n-2)$  when  $n = 2, 3, 4, \dots, f(0) = 0,$

$F(1) = 1$  then  $f(7) = ?$

- (a) 3 (b) 5  
 (c) 8 (d) 13

**Answer: d****Explanation:**(d)  $F(n) = f(n-1) + f(n-2)$  $F(2) = f(1) + f(0) = 1 + 0 = 1 = f(2)$  $F(3) = f(2) + f(1) = 1 + 1 = 2 = f(3)$  $F(4) = f(3) + f(2) = 2 + 1 = 3$ 

Similarly,

$$\begin{aligned}
 f(7) &= f(6) + f(5) \\
 f(7) &= [f(5) + f(4) + [f(4) + f(3)]] \\
 f(7) &= [f(4) + f(3) + f(4)] + (f(4) + f(3)) \\
 f(7) &= [3 + 2 + 3] + [3 + 2] \\
 r(7) &= 13
 \end{aligned}$$

**Question 3**

$$f(x) = x + \frac{1}{x} \text{ find } f^{-1}(y)$$

(a)  $\frac{1}{(x-1)}$

(b)  $\frac{1}{(y-1)}$

(c) 1\_1

(d) x

**Answer: a****Explanation:**

(a)  $F(x) = \frac{x+1}{x}$  .....Equation (1)

Let  $f(x) = y$

$X = f^{-1}(y)$

Further Solving .....Equation (1)

$Y = \frac{x+1}{x}$

$XY = x + 1 \Rightarrow xy - x = 1 \Rightarrow x(y - 1) = 1$

$X = \frac{1}{(y-1)}$

$f^{-1}(y) = \frac{1}{(y-1)}$

$f^{-1}(y) = \frac{1}{(x-1)}$

**DEC 2020****Question 1**

Two finite sets respectively have x and y number of elements. The total number of subsets of the first is 56 more than the total no. of sub sets of the second. The values of x,y are respectively \_\_\_\_

(a) 4 and 2

(b) 6 and 3

(c) 2 and 4

(d) 3 and 6

**Answer: d****Explanation:**

Let A has x elements

Let B has y elements

Total number of students of A =  $2^m$ Total number of students of B =  $2^n$ It is given  $\Rightarrow 2^m - 2^n = 56$ 

$2y(2x - y - 1) = 56$

 $\Rightarrow 2^y = \text{even}$  and  $2^{x-y} - 1 = 0$  Basic odd

Now,

$56 = 8 \times 7 = 2^3 \times 7$

$\Rightarrow 2^y (2^{x-y} - 1) = 2^3 \times 7$

$\Rightarrow n = 3$

Now,  $8(2^{y-3} - 1) = 8 \times 7$

$\Rightarrow 2^{y-3} - 1 = 7$

$\Rightarrow 2^{y-3} = 8 = 2^3$

$$\Rightarrow y - 3 = 3$$

$$\Rightarrow y = 6.$$

**Question 2**

The number of items in the set A is 40, in the Set B is 32; in the Set C is 50; in both A and B is 4; in both A and C is 5; in both B and C is 7; in all the set is 2. How many are in only one set?

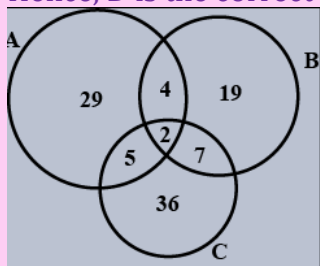
- (a) 96 (b) 110  
(c) 106 (d) None of these

**Answer: d**

**Explanation:**

$\therefore$  In only one set,  
There are  $29 + 19 + 36$   
 $= 84$

Hence, D is the correct option.

**Question 3**

The set of cubes of natural numbers is

- (a) Null set (b) Finite set  
(c) Infinite set (d) A finite set of three numbers

**Answer: c**

**Explanation:**

A set is countably infinite if its elements can be put in one-to-one correspondence with the set of natural numbers. For example, the set of integers  $\{0, 1, -1, 2, -2, 3, -3, \dots\}$  is clearly infinite.

**Question 4**

The inverse function  $f^{-1}$  of  $F(y) = 3x$  is \_\_\_\_\_

- (a)  $1/3y$  (b)  $y/3$   
(c)  $-3y$  (d)  $1/y$

**Answer: b**

**Explanation:**

$$F(y) = 3x$$

$$y = 3x$$

$$x = \frac{y}{3}$$

$$y = \frac{x}{3} \text{ so } x = \frac{y}{3}$$

**JAN 2021**

**Question: 1**

The set of cubes of natural number is

- (a) Null set (b) A finite set  
(c) An infinite set (d) Singleton set



$$\begin{aligned}
 &= n(U) - \{n(A) + n(B) + n(A \cap B)\} \\
 &= 650 - \{310 + 190 - 95\} \\
 &= 245
 \end{aligned}$$

**Question 2**

The range of function  $f$  defined by  $f(x) = \sqrt{16 - x^2}$  is

- (a)  $[-4,0]$  (b)  $[-4,4]$   
 (c)  $[0,4]$  (d)  $(-4,4)$

**Answer: Options (c)**

**Explanation:**

Since square root can only take positive value so

$$-4 \leq x \leq 4 \Rightarrow \sqrt{16 - x^2} \in [0,4]$$

Hence, option 'C' is correct.

**Question 3**

Let  $A = \mathbb{R} - \{3\}$  and  $B = \mathbb{R} - \{1\}$ . Let  $f: A \rightarrow B$  defined by  $f(x) = \frac{x-2}{x-3}$  what is value of  $f^{-1}\left(\frac{1}{2}\right)$ ?

- (a)  $2/3$  (b)  $3/4$   
 (c)  $1$  (d)  $-1$

**Answer: Options (c)**

$$A = \mathbb{R} - 3, B = \mathbb{R} - 1$$

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

$f: A \rightarrow B$  defined as

Let,  $x, y \in A$  such that  $f(x) = f(y)$

$$\Rightarrow \frac{x-2}{x-3} = \frac{y-2}{y-3}$$

$$\Rightarrow x - 2y - 3 = y - 2x - 3$$

$$\Rightarrow xy - 3x - 2y + 6 = xy - 3y - 2x + 6$$

$$\Rightarrow -3x - 2y = -3y - 2x$$

$$\Rightarrow 3x - 2x = 3y - 2y$$

$$\Rightarrow x = y$$

$\therefore f$  is one - one.

**Question 4**

If  $f(x) = x^2 - 1$  and  $g(x) = |2x + 3|$ , then  $f \circ g(3) - g \circ f(-3) =$

- (a) 71 (b) 61  
 (c) 41 (d) 51

**Answer: Options (b)**

## DEC 2021

**Question 1**

Out of group of 20 teachers in a school, 10 teach mathematics, 9 teach Physics and 7 teach Chemistry. 4 teach Mathematics and Physics but none teach both mathematics and chemistry. How many teach chemistry and Physics; how many teach only Physics?

- (a) 2, 3 (b) 3, 2

(c) 4, 6

(d) 6, 4

**Answer: a****Explanation:**

Let the number of teachers teaching both physics and chemistry be  $x$

In the absence of information, it is safe to assume that all the teachers teach at least one of the subjects. Therefore,

$$9-x-0-4-x+7-x-0-0+4+0+0+6=20$$

$$=9-4+7+4+6-x+x-x=20$$

$$\Rightarrow x=22-20=2$$

Therefore, number of teachers teaching both physics =  $9-2-4=3$

**Question 2**

**If a related to b if and only if the difference in a and b is an even integer. This relation is**

- (a) Symmetric, reflexive but not transitive      (b) symmetric, transitive but not reflexive  
 (c) transitive, reflexive but not symmetric      (d) equivalence relation

**Answer: d****Explanation:****1. Check for Reflexivity:**

(a) A relation is reflexive if every element has a relation with itself.

(b) In this question, the relation exists only if the difference between the elements is an even integer.

(c) Take, for example, the number 2. Now, for this relation to be a reflexive relation, this element 2 would have to have a relation with itself.

(d)  $2-2=0$ , which is an even integer.

(e) Therefore, any element can have a relation with itself, and hence, this is a reflexive relation.

**2. Check for Symmetry:**

(a) A relation is symmetric if  $(a, b) \in R \Rightarrow (b, a) \in R$ .

(b) Take two integers, 2 and 6.

(c) Here,  $2-6=-4$ , which is an even integer.

(d) Also,  $6-2=4$ , which is an even integer.

(e) Therefore,  $(2, 6) \in R$  and  $(6, 2) \in R$ .

(f) Therefore, this is a symmetric relation.

**3. Check for Transitivity:**

(a) A relation is transitive if  $(a, b) \in R$ , and  $(b, c) \in R \Rightarrow (a, c) \in R$ .

(b) Take the values of a, b, and c to be 2, 6, and 10 respectively.

(c) Now,  $a=2$ ;  $b=6$ ;  $c=10$



(d) Clearly,  $(a, b) \in R$  as  $2 - 6 = -4$ , which IS an even integer.

(e) Also,  $(b, c) \in R$  as  $6 - 10 = -4$ , which is an even integer.

(f) Also,  $(a, c) \in R$  as  $2 - 10 = -8$ , which is an even integer.

(g) Therefore, this relation is a transitive relation.

Since this relation is a Reflexive, Symmetric, as well as a Transitive Relation, it is an Equivalence Relation.

### **Question 3**

If  $u(x) = \frac{1}{1-x}$  then  $u'(x)$  is:

(a)  $\frac{1}{x-1}$

(b)  $1-x$

(c)  $1 - \frac{1}{x}$

(d)  $\frac{1}{x} - 1$

**Answer:**

**Explanation:**

Let  $y = u(x)$

Therefore,  $y = \frac{1}{1-x}$

$$y(1-x) = 1$$

$$y - xy = 1$$

$$y - 1 = xy$$

$$xy = y - 1$$

$$x = \frac{y-1}{y}$$

Now, simply replace  $x$  with  $u^{-1}(x)$ , and  $y$  with  $x$ , and you'll get the answer

$$u^{-1}(x) = \frac{x-1}{x}$$

$$u^{-1}(x) = \frac{x}{x} - \frac{1}{x}$$

$$u^{-1}(x) = 1 - \frac{1}{x}$$

## **JUNE 2022**

### **Question 1**

$f(x) = \{(2, 2); (3, 3); (4, 4); (5, 5); (6, 6)\}$  be a relation of set  $A = \{2, 3, 4, 5, 6\}$

It is a:

(a) Reflexive and Transitive

(b) Reflexive and Symmetric

(c) Reflexive only

(d) An equivalence

**Answer: Options (c)**

**Explanation:**

If  $f(x) = \{(2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$

be the Relation of  $A = \{2, 3, 4, 5, 6\}$

It is a Reflexive only.

**Question 2**

If  $f(y) = \frac{y-1}{y}$ , find  $f^{-1}(x)$ .

(a)  $\frac{1}{1-y}$

(b)  $y$

(c)  $\frac{y}{y-1}$

(d)  $\frac{y}{1-y}$

**Answer: Options (a)**

**Explanation:**

$$\text{Given } f(y) = \frac{y-1}{y}$$

$$\text{Let } f(y) = x \Rightarrow y = f^{-1}(x)$$

$$x = \frac{y-1}{y}$$

$$xy = y - 1$$

$$xy - y = -1$$

$$y((x-1)) = -1$$

$$y = \frac{-1}{(x-1)}$$

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

$$f^{-1}(y) = \frac{-1}{(y-1)} = \frac{1}{1-y}$$

**Question 3**

Two finite sets have  $x$  and  $y$  number of elements. The total number of subsets of first is 56 more than the total number of subsets of second. The value of  $x$  and  $y$  is:

(a) 6 and 3

(b) 4 and 2

(c) 2 and 4

(d) 3 and 4

**Answer: Options (a)**

**Explanation:**

$$\text{Let set } A = \{1, 2, 3, \dots, x\}$$

$$\text{No. of subsets of } A = 2^x$$

$$\text{and Set } B = \{1, 2, 3, \dots, y\}$$

$$\text{No. of subset of } B = 2^y$$

$$\text{Given, } 2^x = 2^y + 56 \dots\dots\dots(1)$$

Hits &  $x = 6, y = 3$  is satisfied this equation,

So  $x = 6$  and  $y = 3$ .

**Question 4**

Given  $A = \{2, 3\}$ ,  $B = \{4, 5\}$ ,  $C = \{5, 6\}$  then  $A \times (B \cap C)$  is:

(a)  $\{(2, 5), (3, 5)\}$

(b)  $\{(5, 2), (5, 3)\}$

(c)  $\{(2, 3), (5, 5)\}$

(d) None of these

**Answer: Options (a)**

**Explanation:**

$$A = \{2, 3\}, B = \{4, 5\}, C = \{5, 6\}$$

$$B \cap C = \{5\}$$

$$A \times (B \cap C) = \{2, 3\} \times \{5\}$$

$$= \{(2, 5), (3, 5)\}$$

**Question 5**

If the universal set  $E = \{x : x \text{ is a positive integer } < 25\}$ ,  $A = \{2, 6, 8, 14, 22\}$ ,  $B = \{4, 8, 10, 14\}$

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

(b)  $(A \cap B)' = A' \cap B'$

(c)  $(A \cap B)' = \phi$

(d) None of these

**Answer: Options (a)****Explanation:**

If  $E = \{x : x \text{ is a positive Integers } < 25\}$

$$A = \{2, 6, 8, 14, 22\}$$

$$B = \{4, 8, 10, 14\}$$

then  $(A \cap B)' = A' \cup B'$  [Demorgan Law]

$\therefore$  Demorgan law is universal truth.

**DEC 2022****Question 1**

If  $A = \{1, \bar{2}, 3, \bar{4}, 5, \bar{7}, 8, \bar{9}\}$  and  $\{2, 4, 6, 7, 9\}$  then how many proper subset of  $A \cap B$  can be created

a) 16

b) 15

c) 32

d) 31

**Answer: Options (b)****Explanation:**

Given:

$$A = \{1, 2, 3, 4, 5, 7, 8, 9\} \text{ and } B = \{2, 4, 6, 7, 9\}$$

As we know that  $A \cap B = \{x : x \in A \text{ and } x \in B\}$

$$A \cap B = \{2, 4, 7, 9\}$$

As we can see that,

The number of elements present in  $A \cap B = 4$

$$\text{i.e } n(A \cap B) = 4$$

As we know that;

If A is a non-empty set such that  $n(A) = m$  then

The numbers of proper subsets of A are given by  $2^m - 1$ .

So, The number of proper subsets of  $A \cap B = 2^4 - 1 = 15$

Hence, the correct option is 2

**Question 2**

Let  $A = \{1, 2, 3\}$  and consider the relation  $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ , Then R is:

a) symmetric and transitive

b) reflexive but not transitive

c) reflexive but not symmetric

d) neither symmetric, nor transitive

**Answer: Options (c)****Explanation:**

Let  $A = \{1, 2, 3\}$  and consider the relation  $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3), (1, 3)\}$ . Then R is reflexive but not symmetric.

Explanation:

Given that  $A = \{1, 2, 3\}$

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

$$\forall (1, 1), (2, 2), (3, 3) \in R$$

Hence, R is reflexive.

