MATHS

BOOKS - PEARSON IIT JEE FOUNDATION

SETS AND RELATIONS

Solved Ex

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1. If $A = (3, 5, 7, 8)$ and B=(7,8,9,10), then Find the value of $(A \cup B) - (A \cap B)$.

The following are the steps involved in solving the above problem. Arrange them in sequential order.

(A) $A \cup B = (3, 5, , 8, 9, 10)$ and $A \cap B = (7, 8)$

(B) Given $A = (3, 5, 7, 8)$ and B=(7,8,9,10)

(C) $(A \cup B) - (A \cap B) = (3, 5, 9, 10)$

(D) $(A \cup B) - (A \cap B) = (3, 5, 7, 8, 9, 10) - (7, 8)$

.

2. If $n(A) = 8$ and $n(B) = 6$ and the sets A and B are disjoint, then find $n(A \cup B)$.

3. In a locality the number of residents who read only the hindu, only the Times of India. Both the newspaers and neither of the newspapers are in the ratio 2:3:4:1 The number of residents who read at least one of these newspapers is 160 more than those who read neither of these newspapers. find the number of residents in the locality.

4. If $A = (a, b, c)$ and B=(1,2,3) then find $A \times B$.

5. If $A = (a, b, c)$ and B=(1,2,3) then find $A \times B$.

6. If $A = (1, 2, 3)$ and B=(3,4,5), then find $A \times B$.

7.   If $R = \{(x, y), x \in W, y \in W$ and

$(X + 2y)^2 = 36\Big)$, then R^{-1} is_____

(a) {(0,3),(2,,2),(1,4),(0,6)}

(b) {(0,6),(0,3),(2,2),(4,1)}

(c) {(3,0),(2,2),(1,4),(0,6)}

(d) {(3,0),(2,2),(1,4),(6,0)}

8. If $R = \{(x', y) : x \in W, Y \in W$ and $(x + 2y)^2 = 36\}$ then R^{-1} is_____.

(a) $\{(0, 3), (2, 3), (1, 4), (0, 6)\}$

(b) $\{(0, 6), (0, 3), (2, 2), (4, 1)\}$

(c) $\{(3, 0), (2, 2), (1, 4), (0, 6)\}$

(d) $\{(3, 0), (2, 2), (1, 4), (6, 0)\}$

1. If $P = (1, 2, 3, 4, 5, 6, 7)$ and $Q = (2, 5, 8, 9)$, then find $P \cup Q$.

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2. If $P = (1, 2, 3, 4, 5, 6, 7)$ and $Q = (2, 5, 8, 9)$, then find P-Q.

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3. If $P = (1, 2, 3, 4, 5, 6, 7)$ and $Q = (2, 5, 8, 9)$ then find $P \cap Q$.

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4. If $C \subset Y$ and $Y \subset X$, then_____

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5. The complement of ϕ' is_____

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6. $A \cap A' = $_____

7. The symmetric difference of A and B is commutative. (True/False).

8. The cardinal number of a set is 5. find the cardinal number of the power set.

9. The order in which the elements are placed plays an important role in sets (True/False).

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10. In $n(A \cup B) = 16$ and $n(A \cap B) = 4$, then the number of elements in the symmetric difference of A and B is_____

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11. If P and Q are disjoint then $(P \cap Q)'$ is_____

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12. If P and Q are disjoint, then P-Q=_____ and Q-P=_____

13. If V=(a,e,i,o,u), then find the number of non empty proper subsets of V.

14. If a set has 510 non-empty proper subsets, then find the cardinal number of the set.

15. If A is universal set, then $((A')')'$ is_____

16. If $n(P) = 2$ and $n(Q) = 5000,$ then $n(P \times Q) =$ _____

17. If $n(P) = 2439$ and $Q = \phi$ then $n(P \times Q) =$

_____

18. If $P = (a, b, c, d)$ and $Q = (1, 2, 3, 4, 5)$ then

$n(P \times Q)=$_____

19. Let $A = (a, b, c)$ and B=(p,q). Draw the arrow

diagram of $A \times B$.

20. If $n(A) = 6$ and n(B)=3, then find the number of subsets of $A \times B$.

21. Let $A = (x, y, z)$ and B=(p,q), then draw the tree diagram of $A \times B$ and $B \times A$.

22. If $n(P) = 17, n(Q) = 10$ and $n(P \cap Q) = 8$, then $n(P \Delta Q)$ is_____

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23. If $(x, 2p + q) = (y, p + 2q)$ then p-q=_____

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24. If $n(A) = 40$ and n(B)=23, then find n(A-B) and n(B-A) when $B \subset A$.

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25. Find $(P \times Q)$, if $n(Q - P) = 10$ and $n(P - Q) = 13$ and $n(P \cap Q) = 8$.

26. Find the number of relations from A to A, where A=(1,2,3,4).

27. A relation R={a,b),(a,a),(a,c),(x,,x),(x,y),(y,y),(d,d),(d,c)}. Write a relation $E \subset R$ such that x is equal to y.

28. A=(1,2,3,4),B=(3,4) and R={(3,1),(3,2),(4,1),(4,2),(4,3)} is a relation from B into A. write R in set-builder form.

29. $P = (3, 5, 6, 8, 9), Q = (6, 10, 12, 16, 17)$ and R $= \{(x, y) / (x, y) \in P \times Q, 2x = y\}$ is a relation from P into Q, write R in list form.

30. If $n(X \cap Y) = 9, n(Y \cap X') = 10$ and $n(X \cup Y) = 25$, then find $n(X \times Y)$.

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Short Ans

1. If A=(2,3,4,,7,9,10,12),B=(1,3,5,8,9,10,11,15),C= (3,4,7,10,11,13,15) and $\mu = (1, 2, 3, \dots .15)$ Then find $(A \cup B)$.

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2. If A=(2,3,4,6,7,9,10,12),B=(1,3,5,8,9,10,11,15),C= (3,4,7,10,11,13,15) and $\mu - (1, 2, 3, \ldots, 15)$, then find $(A \cup B \cup C)'$.

3. If n(X-Y)=30+a,n(Y-X)=20+2a,n$(X \cup Y)$ =100 and $n(X \cap Y) = 15 + 2a$, then find a.

4. If $m(P \Delta Q) = n(P \cup Q)$, then P and Q are _____

5. If $n(A - B) = 25, n(B - A) = 15$ and $(A \cup B) = 60$. Then $a(A \cap B) = $ _____

6. If $n(P \cap Q) = 12$ and $n(Q) = 37$, then find the value of $n(P' \cap Q)$.

7. In a colony of 170 members 70 subscribe Deccan Chronicle and 120 subscribe Times of India. How many subscribe only Deccan Chronicle? (Each subscribes at least one.)

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8. $A = (1, 2, 3, 4)$ and $f(x) = 2x^2, x \in A$ If f(x)=18, then find x.

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9. Write the following sets in the roster from.

(i) $\qquad P = \{x\,/\,x \in W \text{and} x \not\in N)$ (ii)

$S = \{f\,/\,f\text{is a factor of}13\}$

10. A, B and C are three different sets and

$A \times (B \cap C) = (A \times B) \cap (A \times C).$ Judge the

given statemetns by taking any three non empty sets

A,B and C (True/False).

11. Given that

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

A=(1,2,3) which property is not satisfied by R on A?

12. What type of relation does R define on the set of

integers, if x+y=8?

13. In a class of 50 students 20 take Sanskrit but not

Hindi and 37 take Sanskrit. How many students take

Hindi but not Sanskrit? (Each student takes either Sanskrit or Hindi).

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14. In a class of 60 students, 25 speaks. Hindi, 45 speak English. How many of them speak both English and Hindi, if each student speaks either English or Hindi?

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15. In term examination 40% students failed in English, 32% failed in Physcial Science. What is the pass percentage, if 10% failed in both?

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Easy Type

1. The following figure depicts the number of families subscribed for three different newspapers, i.e., Eenadu (E), Hindu (H) and Vaartha (V).

Find the number of people who read
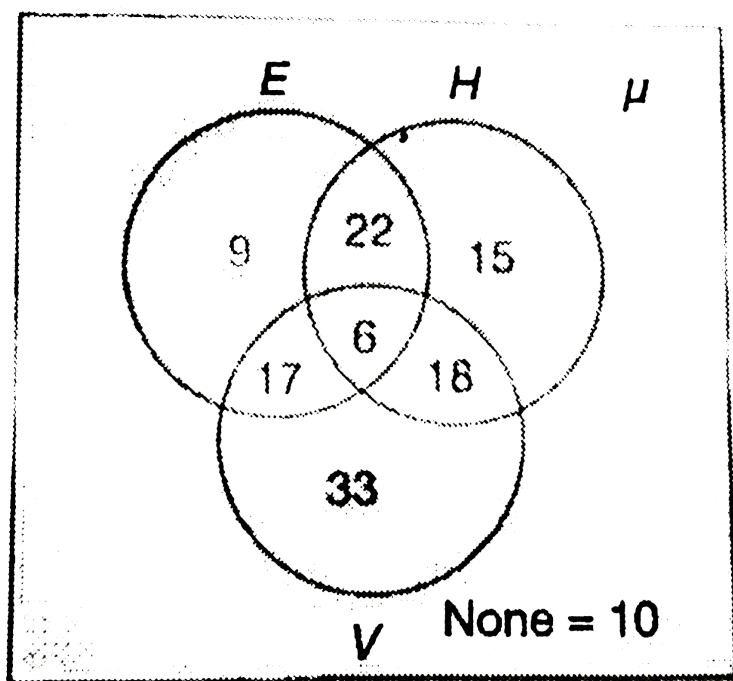
(i) atleast two papers

(ii) atmost two papers

(iii) atleast three papers

(iv) almost three papers

(v) atleast one paper.

(vi) almost one paper.

2. On the set of all colleges in a state, a relation R is defined such that two colleges are related if they belong to the same district. Find the properties satisfied by R.

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3. In a set of studnets studying in the same class, two students are related 'if their weights are not equal' find the properties satisfied by it.

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4. If a set A has 4 elements and a reflexive relation R defined in set A has x elements, then what is the range of x?

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5. In a club 45% plays cricket, 20% plays only football. Find the percentage of members who plays only cricket if 10% play both. (Each plays at least one).

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Level 1

1. Which of the following cannot be the cardinal number of the power set of any finite set?

    A. 26

    B. 32

    C. 8

    D. 16

Answer: A

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2. Consider the following statements.

$p: 3 \in (1, (3), 5, 7)$

$q, 2 \in (1, (3, 4), 4)$

Which of the following is true?

    A. p alone

    B. q alone

    C. Both p and q

    D. Neither p nor q.

Answer: D

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3. If $A = (1, 2, 3)$ and $B = (2, 6, 7)$, then $(A - B) \cup (B - A) =$

A. ϕ

B. μ

C. $(1, 2, 3, 6, 7)$

D. $(1, 3, 6, 7)$

Answer: D

4. If (x-y,x+y)=(2,8), then the values of x and y are respectively.

A. 5,3

B. 7,5

C. 4,2

D. 10,8

Answer: A

5. If $X = \left(x : x^2 - 12x + 20 = 0\right)$ and $Y = \left(x : x^2 + 5x - 14 = 0\right)$, then X-Y=

A. (2)

B. (10)

C. (-7)

D. $()$

Answer: B

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6. The number of subsets of $A \times B$ if n(A)=3 and n(B)=3 is

A. 512

B. 256

C. 511

D. 235

Answer: A

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7. If A=(1,2,3,4) then how many subsets of A contain the elements 3?

A. 24

B. 28

C. 8

D. 16

Answer: C

8. In 'aRb' a and b have the same teacher', then R is_____

A. reflexive

B. symmetric

C. transitive

D. equivalence

Answer: D

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9. A relation $R: Z \to 2$ is such that $R = \{(x, y) / y = 2x + 1)$ is a

A. one to one relation.

B. many to one relation.

C. one to many relation.

D. many to many relation.

Answer: A

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10. If p_n is the set of first n prime numbers, then $\bigcup\limits_{n=2}^{10} P_n =$

    A. {2,3,5,7,11,13,17,19}

    B. {3,5}

    C. {2,3,5,7,11,13,17,19,23,29}

    D. {2,3}

Answer: C

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11. If P_n is the set of first n prime numbers, then $\bigcap_{n=3}^{10} P_n$ is

A. {3,5,7,11,13,17,19}

B. {2,3,5}

C. {2,3,5,7,11,13,17}

D. {3,5,7}

Answer: B

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12. If $n(\mu) = 100, n(A) = 50, n(B) = 20$ and $n(A \cap B)$=10, then $n[(A \cup B)] =$

A. 60

B. 30

C. 40

D. 20

Answer: C

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13. Let Z denote the set of integers, then

$(x \in Z, |x - 3| < 4 \cap \{x \in Z : |x - 4| < 5\} =$

A. {-1,0,1,2,3,4}

B. {-1,0,1,2,3,4,5}

C. {0,1,2,3,4,5,6}

D. {-1,0,1,2,3,5,6,7,8,9}

Answer: C

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14. If $A = \left\{ n : \dfrac{n^3 + 5n^2 + 2}{n} \right.$ is an integer and n

itself is an integer}, then the number of elements in

the set A is

   A. 1

   B. 2

   C. 3

   D. 4

Answer: D

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15. If A=(1,2,3), then the relation R={(1,1)(2,2),(3,1),(1,3)}` is

    A. reflexive.

    B. symmetric

    C. transitive.

    D. equivalence.

Answer: B

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16. If $n(A \times B)$ =45, then n(A) cannot be

A. 15

B. 17

C. 5

D. 9

Answer: B

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17. If A,B and C are three non=empty sets such that A

and B are disjoint and the number of elements

contained in A is equal to those contained in the set

of elements common to the set A and C, then

$(A \cup B \cup C)$ is necessarily equal to

A. $n(B \cup C)$

B. $n(A \cup C)$.

C. Both and and b

D. None of these.

Answer: A

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18. R and S are two sets such that n(R)=7 and R ∩ S

$\neq \phi$ Further n(S)=6 and S ΔR. The greatest. Possible

value of $n(R \Delta S)$ is____

A. 11

B. 12

C. 13

D. 10

Answer: A

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19. Consider the following statements:

(i) Every reflexive relation is anti-symmetric.

(ii) Every symmetric relation is anti-symetric which among i and ii is true?

    A. i alone is true

    B. ii alone is true

    C. Both i and ii are true

    D. Neither i nor ii is true.

Answer: D

20. The relation is not equal to is defined on the set of real numbers is satisfies which of the following?

A. Reflexive only

B. Symmetric only

C. Transitive only

D. equivalence.

Answer: B

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21. If $R = \{(a, b) / |a + b| = |a| + |b|\}$ is a relation

on a set $\{-1, 0, 1\}$ then R is_

A. reflexive

B. symmetric

C. anti symmetric

D. equivalence.

Answer: D

22. For all p, such that $1 \le p \le 100$, if $n(A_p)$=p+2 and $A_1 \subset A_2 \subset A_3 \subset \ldots \subset A_{100}$ and $\bigcap_{p=3}^{100} A_p = A$, then n(A)=

A. 3

B. 4

C. 5

D. 6

Answer: C

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23. If R={(a,b)//a+b=4} is a relation on N, then R is____

A. reflexive

B. symmetric

C. anti symmetric

D. transitive.

Answer: B

24. Let R be a relation defined on S, the set of squares on a chess board such that xRy iff x and y share a common side. Then, which of the following is false for R?

A. Reflexive only

B. Symmetric

C. Transitive

D. All the above.

Answer: C

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25. Let A = {ONGC, BHEL, SAIL, GAIL, IOCL} and R be a relation defined as "two elements of A are related if they share exactly one letter". The relation R, is

A. anti-symmetric

B. only transitive

C. only symmetric

D. equivalence.

Answer: C

26. X is the set of all engineering colleges in the state

of A.P and R is a relation on X defined as two colleges

are realted iff they are affiliated to the same

university then R. is

    A. only reflexive

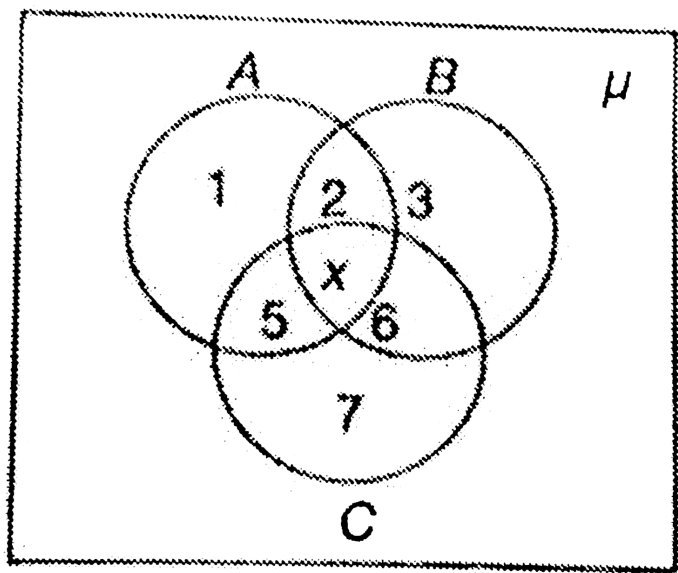   B. only symmetric.

    C. only transitive.

D. equivalence.

Answer: D

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27. In the following figure, which of the following can

be the value of $(A \cup B \cup C)$? In the figure, 1, 2,3,. . . .

.represetns the number of elements in the respective

regions.

A. 22

B. 23

C. 24

D. 25

Answer: C

28. In a class, each student likes either cricket or football 40% of the students like football. 80% of the students like cricket. The number of studnets who like only cricket is 40 more than the number of students who like only football. What is the strength of the class?

A. 80

B. 100

C. 120

D. 150

Answer: B

29. For all p, such that $1 \leq p \leq 100$, $n(A_p) = p + 1$

and $A_1 \subset A_2 \subset \ldots \subset A_{100}$. Then $\bigcup\limits_{p=1}^{100} A_p$

contains. _____elements

A. 99

B. 100

C. 101

D. 102

Answer: C

Level 2

1. In class , 70 students wrote two tests, viz,. Test-I and Test-II. 50% of the students failed in Test-I and 40% of the students failed in Test-II. How many students passed in both the tests?

    A. 21

    B. 7

C. 28

D. 14

Answer: B

2. Every man in a group of 20 men likes either mangoes or an apple. Every man who likes apples also likes mangoes, 9 men like mangoes but not applies. How many like mangoes and apples?

A. 9

B. 11

C. 10

D. 12

Answer: B

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3. In an election, two contestants A and B contested.

X% of the total voters voted for A and (x+20)% for B.

if 20% of the voters did not vote, then find x.

A. 30

B. 25

C. 40

D. 35

Answer: A

4. If $A = (1, 2, 3, 4)$, then how many subsets of A contain the element 1 but not 4?

A. 16

B. 4

C. 8

D. 24

Answer: B

5. A relation R: $Z \to Z$ defined by $R = \{(x, y) / y = x^2 - 1\}$ is

A. one to one relation.

B. many to one relation.

C. many to many relation

D. many to many relation.

Answer: B

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6. If a set A has 13 elements and R is a reflexive relation on A with a elementss, $n \in Z^+$, then

A. $13 \le n \le 26$

B. $0 \le n \le 26$

C. $13 \le n \le 169$

D. $0 \le n \le 169$

Answer: C

7. Example of an equivalence relation among the following is

A. is a father of

B. is less than

C. is congruent to

D. is an uncle of

Answer: C

8. If A=$\{p \in N, p$ is a prime and $p = \dfrac{7n^2 + 3n + 3}{n}$

for some $n \in N$), then the number of elements in

the set A is

   A. 1

   B. 2

   C. 3

   D. 4

Answer: A

9. aRb' if a is the father of b. then R is ____

    A. reflexive

    B. symmetric

    C. transitive

    D. None of these.

Answer: D

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10. Let A be a set of compartments in a train. Then the relation R defined on A as aRb iff "a and b have

the link between them", then which of the following is true for R?

A. Reflexive

B. symmetric

C. Transitive

D. many to many.

Answer: B

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11. A relation $R, N \to N$ defined by

$R = \{(x, y) / y = x^2 + 1\}$ is

A. one to one

B. one to many

C. many to one

D. many to many.

Answer: A

12. If $R = \{(a, b) / |a + b| = a + b\}$ is a relation

defined on a set (-1,0,1) then R is____

A. reflexive

B. symmetric

C. anti symmetric

D. transitive.

Answer: B

13. Set builder form of the relation

$$R = \{(- 2, \; - 7), (- 1, \; - 4), (0, \; - 1), (1, 2), (2, 5)\}$$

is

A. $R\{(x, y) / y = 2x - 3, x, y \in Z\}$

B. $R = \{(x, y) / y = 3x - 1, x, y \in Z\}$

C. $R = \{(x, y) / y = 3x - 1, x, y \in N\}$

D. $R = \{(x, y) / y = 3x - 1, \; -2 \leq x < 3 \quad$ and

$x \in Z\}$

Answer: D

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14. A group of 30 men participate in a sruvey on language skills. The number of men whoe know both English and Hindi was equal to the number of men who know neither of these language . The number of

men who know English is 4 more than those who know Hindi. How many know Hindi?

A. 11

B. 12

C. 13

D. 14

Answer: C

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15. In a locality the number of people buying only The Times of India is 80% of the number of people

buying both. The Times of India and The Hindu. The number of people buying only The Hindu is 60% less than the number who buy both. The number of people buying neither of these is 22,000 less than the number of people in the locality. how many people buy both newspapers?

    A. 10000

    B. 20000

    C. 25000

    D. 30000

Answer: A

16. Find the number of subsets of $A \times B$, if n(A)=2 and n(B)=4

The following are the steps involved in solving the above problem. Arrange them in sequential order (A) The number of elemetns in $A \times B$ is $4 \times 2 = 8$.

(B) The number of subsets of a set with n elements = 2^n

(C) Given $n(A) = 2$ and $n(B) = 4$.

(D) $\therefore$ Required number of subsets is $2^8 = 256$.

A. CBAD

B. CABD

C. CDAB

D. CBDA

Answer: B

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17. If $x = (1, 2, 3, 4, 5, 6)$ and $A = (1, 2, 3, 4)$ and $B = (3, 4, 5, 6)$ then find $A \cap B$. The following are the step involved in solving the above problem. Arrange them in sequential order.

(A) $A = (5, 6)$ and B'=(1,2)

(B) $A' \cap B = (5, 6) \cap (1, 2)$

(C) We know that A=x-A and B=x-B.

(D) $A \cap B = \phi$

A. CBAD

B. CDBA

C. CABD

D. CADB

Answer: C

18. If $A = (1, 2)$ and B=(2,3), then find the number of elements in $(A \times B) \cap (B \times A)$. The following are

the steps involved in solving the above problem.

Arrange them in sequential order.

(A) $(A \times B) \cap (B \times A) = (2, 2)$

(B) Given $A = (1, 2)$ and B=(2,3)

(C) $n[)A \times B) \cap (B \times A)] = 1$

(D) $A \times B = \{(1, 2)(1, 3)(2, 2)(2, 3)\}$ and

$B \times A = \{(2, 1), (2, 2), (\#, 1), (3, 2)\}$

A. BADC

B. BDCA

C. BCAD

D. BDAC

Answer: D

19. The number of subsets of $\{(a), (b, c), d, e\}$ is

_____

A. 32

B. 16

C. 8

D. 20

Answer: B

20. If $R = \{(a, a), (a, c), (b, c), (b, b), (c, c), (a, b)\}$ on the set $X = (a, b, c)$, then how many subsets of R are reflexive relations?

A. 15

B. 16

C. 8

D. 9

Answer: C

21. The relation $R = \{(2, 3), (1, 1), (1, 3), (3, 1)\}$ on the set $A = (1, 2, 3)$ is_____

A. Reflexive only

B. symmetric

C. transitive

D. Both b and c

Answer: B

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22. Which of the following statement(s) is/are true?

(A) Every subset of an infinite set is infinite.

(B) Every set has a proper subset.

(C) Number of subsets of every set is even.

(D) Every subset of a finite set is finite

    A. A and B

    B. A,B and C

    C. B, C and D

    D. D

Answer: D

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23. If A and B are two non empty sets and $n(A \times B) = 36$, then which of the following cannot be equal to $n(B)$?

A. 9

B. 6

C. 8

D. 12

Answer: C

24. If the number of reflexive relations defined on a set A is 64, then the number of elements in A is _____

A. 3

B. 2

C. 6

D. 5

Answer: A

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Level 3

1. In a rehabitation programe, a group of 50 families were assured new houses and compensation by the government . Number of families who got both is equal to the number of families who got neither of the two. The number of families who got new house is 6 greater than the number of families who got compensation. How many families got houses?

A. 22

B. 28

C. 23

D. 25

Answer: B

2. In an office, every employee likes at least one of tea, coffee and milk. The number of employees who like only tea, only coffee, only milk and all the three are all equal. The number of emploees who like only tea and coffee, only coffee and milk and only tea and milk are equal and each is equal to half the number of employees who like all the three then a possible value of the number of employees in the office is_____

A. 65

B. 90

C. 77

D. 84

Answer: C

3. In a school, on the Republic day, three dramas A, B and C are performed on the dais. In a group of people, who attended the function and who like at least one of the three dramas, 16 people like A,20 people like B,15 people like C,4 people like both A and

B,3 people like all the three. Then how many people like at most two?

A. 59

B. 41

C. 4

D. 6

Answer: B

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4. The students of a class like at least one of the games out of Chess, Caroms and Judo. The number of

students who like only Chess and Caroms, only Caroms and Judo, only Chess and Judo and the number of those who like all the three are equal. The number of students who like only Chess, only Caroms, only Judo and the number of those who like all the three are equal. A possible value of the number of students in the class is

A. 30

B. 40

C. 50

D. 70

Answer: D

5. There are a total 70 ladies who watch at least one of the channels i.e., Zee TV. Sony TV and Star Plus. The total number of ladies who watch Zee or sonly but not star plus, the number of ladies who watch Sony or star plus butnot Zee and the number of ladies who watch star plus or Zee but not Sony is 90. how many ladies watch at least two of these channels if 10 ladies watch all the three chanels?

A. 25

B. 30

C. 40

D. 35

Answer: C

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6. If $R = \left\{ (x, y) \, / \, x \in W, y \in W, (2x + y)^2 = 49 \right\}$

, then R^{-1} is____

  A. {(5,1),(3,2),(1,3)}

  B. {(7,0),(5,1),(3,2),(1,3)}

  C. {(7,0),(1,5),(2,3),(1,3)}

D. {(0,7),(5,1),(3,2),(1,3)}

Answer: B

7. Which of the following cannot be the number of

reflexive relation defined on a set A?

A. 1

B. 4

C. 4096

D. 512

Answer: D

8. In a class, the number of students who like only Chess, only Caroms, both the games and neither of the games are in the ratio $2:4:1:3.$ the number of students who like at least one of these games is 120 more than those who like neither of the games. Find the number of students in the class.

   A. 300

   B. 240

C. 270

D. 360

Answer: A

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