

# Sets, Relations and Functions

2

1m	2m	3m	4m	5m	Total
1(K)	1(K)	1(K)	1(U)	1(K)	15

## 1 MARK QUESTIONS

- If set A has 4 elements, how many elements will  $P(A)$  have? (Knowledge)
- Convert to set builder form:  $A = \{4, 8, 12, \dots\}$
- Convert to Roster form  
 $A = \{x : x \text{ is a letter in the word 'ENGINEERING'}\}$
- If  $A = \{1, 2\}$  &  $B = \{a, b\}$  then find  $B \times A$ .
- If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 3x + 4$  then find  $f\left(\frac{1}{3}\right)$ .
- If  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{1, 2, 3, 4, 5, 6, 7, 8\}$ . Find  $A - B$ .
- If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 3x - 5$  then find  $f(-2)$ .
- If  $f(x) = x + 1$  and  $g(x) = x^2 + 1$  find  $\text{fog}(1)$ .
- If  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{1, 2, 3, 4\}$  and R is a relation from A to B defined by  $R = \{(x, y) : y = 2x + 1\}$  find R.
- If  $A = \{1, 2, 3, 4, 5\}$ . Find a relation from A to B defined by  $R = \{(x, y) : x > y\}$ .
- A function  $f(x)$  is defined as  $f(x) = 2x + 1$ . Find the value of  $f(-3)$ .
- If  $R = \{(1, a) (1, b) (2, a)\}$  then find  $R^{-1}$ .
- Define equivalence relation.
- Give an example of a relation which is transitive but not reflexive and not symmetric.
- If  $A = \{2, 3\}$ ,  $B = \{3, 4\}$ . Find the number of relations that can be defined from A to B.

## 2 MARKS QUESTIONS

- Represent "Set of prime numbers less than 20" in both roster form and set builder form. (Knowledge)
- If  $A = \{a, b, c\}$ , how many elements will  $P(A)$  have? Write all the possible subsets of A.
- If  $A = \{a, b, c, d\}$ ,  $B = \{d, e, f, g\}$ . Find  $(A - B) \times A$ .
- If  $A \times B = \{(a, 1) (a, 2) (a, 3) (b, 1) (b, 2) (b, 3)\}$ . Find A and B.
- If  $(2x + 4, 3x + y) = (8, 0)$ . Find x and y.
- If  $(x + y, x - y) = (5, 1)$ . Find x and y.

## QUESTION BANK

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7. If  $U = \{a, b, c, d, e, f, g\}$ ,  $A = \{a, b, c, d\}$ ,  $B = \{b, d, f, g\}$ . Find  $(A \cap B)'$ .
8. If  $A = \{1, 3, 5, 7, 9\}$ ,  $B = \{2, 4, 6, 8, 10, 12\}$ . Define a function  $f: A \rightarrow B$  by  $f(x) = x + 1$   $\forall x \in A$ . Is the function one-one and onto.
9. If  $A = \{x : x \in \mathbb{N} \text{ and } x < 3\}$  and  $B = \{x : x^2 - 16 = 0 \text{ and } x > 0\}$ . Find  $B \times A$ .
10. If  $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$ ,  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5, 6\}$ . Verify  $(A \cup B)' = A' \cap B'$ .
11. Find the domain and range of  $R = \{(1, 2) (1, 3) (1, 4) (1, 5) (1, 6) (1, 7)\}$ .
12. If  $f(x) = x - 1$  and  $g(x) = 2x^2 - 3$ . Find  $\text{fog}(2)$  and  $\text{gof}(2)$ .
13. If  $f(x) = x^3$ . Find the value of  $\frac{f(3) - f(2)}{3 - 2}$ .
14. If  $A = \{3, 5, 7\}$ ,  $B = \{5, 7, 9\}$ . Find  $(A \cap B) \times (B - A)$ .
15. If  $A = \{1, 2\}$ ,  $B = \{2, 3\}$ ,  $C = \{3, 4\}$ . Find  $A \times (B \cup C)$ .
16. If  $A \times B = \{(-1, a) (-1, b) (-2, a) (-2, b) (3, a) (3, b)\}$ . Find A and B.
17. If X and Y are two sets such that  $X \cup Y$  has 50 elements, X has 28 elements and Y has 32 elements, how many elements does  $X \cap Y$  have.

## 3 MARKS QUESTIONS

1. A relation R on a collection of set of integers defined by  $R = \{(x, y) : x - y \text{ is a multiple of } 3\}$ . Show that R is an equivalence relation on Z. **(Knowledge)**
2. A relation R is defined on the set of integers by  $R = \{(x, y) : x - y \text{ is a multiple of } 5\}$ . Show that R is an equivalence relation on Z.
3. Show that the relation 'is congruent to' is an equivalence relation. On a set T of triangles.
4. Let N be the set of natural numbers such that  $R = \{(x, y) : y = 3x + 4, x, y \in \mathbb{N}\}$ . Write the relation R, domain and range of the function.
5. Given,  $A = \{2, 4, 6, 8\}$  and  $R = \{(2, 4) (4, 2) (4, 6) (6, 4)\}$ . Show that R is not reflexive, symmetric and not transitive.
6. Let  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5, 6\}$ ,  $C = \{5, 6, 7, 8\}$ . Verify  $A \cup (B \cap C) = (A \cup B) \cap C$ .
7. In a group of 65 people, 40 were found to like hockey, 10 like both tennis and hockey. How many like only tennis but not hockey? How many like tennis? Represent using venn diagram.
8. In a group of 65 people, 40 like cricket, 10 like hockey and cricket both. How many like cricket only and not hockey? How many like hockey?
9. Let  $f = \{(1, 2) (2, 3) (3, 4)\}$  be a function from Z to Z where Z is the set of integers defined by  $f(x) = ax + b \forall$  some integers a and b. Determine a & b.
10. If  $f(x) = x^2$  and  $g(x) = x + 1$ . Find (i)  $\text{fog}(x)$ , (ii)  $\text{gof}(x)$ , (iii)  $\text{fof}(x)$ .
11. If  $n(\cup) = 700$ ,  $n(A) = 200$ ,  $n(B) = 300$  and  $n(A \cap B) = 100$ . Find  $n(A' \cap B')$ .

## BASIC MATHEMATICS

12. Find the domain and range of the function  $f(x) = \frac{x^2 + 2x + 1}{x^2 - 8x - 12} x \in \mathbb{R}$ .
13. If  $R = \{(x, y) : y = x^3, x \text{ is a positive prime less than } 10\}$ . Find the relation R, domain and range of R.

### 4 MARKS QUESTIONS

(Understanding)

1. In a survey of 400 students in a school, 100 were listed as taking apple juice, 150 as taking orange juice and 75 were listed as taking both apple as well as orange juice. Find how many students were taking neither apple juice nor orange juice.
2. Out of 50 people, 20 people drink tea, 10 take both tea and coffee. How many take atleast one of the two drinks.
3. Let  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5, 6\}$ ,  $C = \{4, 5, 6, 7, 8\}$ .

Verify that  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ .

4. Let  $A = \{a, b, c\}$ ,  $B = \{d\}$ ,  $C = \{e\}$ . Verify  $A \times (B - C) = (A \times B) - (A \times C)$ .
5. If  $A = \{x : x^2 - 7x + 12 = 0\}$ ,  $B = \{2, 4\}$ ,  $C = \{4, 5\}$ . Find  $(A - B) \times (B - C)$ .
6. If  $\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ ,  $A = \{2, 4, 6, 8\}$ ,  $B = \{2, 3, 5, 7\}$ .

Verify that (i)  $(A \cup B)' = A' \cap B'$  (ii)  $(A \cap B)' = A' \cup B'$ .

### 5 MARKS QUESTIONS

(Application)

1. In a survey it was found that 31 people like a product A, 36 liked a product B and 39 liked the product C. If 24 people liked products A and B, 22 people liked product C and A, 24 people liked products B and C, 18 liked all the three products, then find how many people liked product C only?
2. Let  $f = \{(1, 1) (2, 3) (0, -1)\}$  be a function from  $Z$  to  $Z$  defined by  $f(x) = ax + b$  for some integers  $a$  and  $b$  (i) Determine  $a$  and  $b$ , (ii) If  $f(x) = 2x + 1$ ,  $g(x) = x^2 + 2x + 1$ . Find  $\text{fog}(2)$  and  $\text{gof}(3)$ .
3. In a group of 150 people, 70 like cricket, 30 like hockey and cricket both. How many like cricket only and not hockey? How many like hockey? Show the result using Venn diagram.
4. Out of 250 people, 160 drink coffee, 90 drink tea, 85 drink milk, 45 drink coffee and tea, 35 drink tea and milk, 20 drink all the three. How many will drink coffee and milk?
5. In a survey of 100 persons it was found that 28 read magazine A, 30 read magazine B, 42 read magazine C, 8 read magazine A & B, 10 read magazine A and C, 5 read magazines B & C, while 3 read all the three magazines. Find how many read none of the 3 magazines. How many read only magazine C?
6. In a certain college with 500 students, 300 take milk and 250 take tea. Find how many take  
(a) milk only (b) tea only (c) both milk and tea.

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