

Exercise 1

1. Given set $A = \{x | x = a^2, 1 < a < 5\}$. Answer the following questions:
 - a) List the elements of set A
 - b) Find $P(A)$
 - c) Find $|\{4, 5, 6, 7, 9\} \cap A|$
2. Given $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{5, 6, 7, 8\}$, $C = \{3, 6, 9\}$. Find:
 - a) $A \cap B$
 - b) B'
 - c) $A' \cup B'$
 - d) $A - B$
 - e) $(A \cap C) \times (A \cup C)$
3. Prove that $(P \cup Q) \cap P = P$ using properties of set.
4. Let $A = \{a, b, c\}$, $B = \{b, c, d\}$, and $C = \{b, c, e\}$. Find each of the following:
 - a) $A \cup (B \cap C)$
 - b) $(A \cup B) \cap C$
 - c) $(A \cup B) \cap (A \cup C)$
 - d) Which of these sets ((a), (b), (c)) are equal?
5. Draw a Venn diagram for sets A, B, and C that satisfy the given condition:
$$A \subseteq B; C \subseteq B; A \cap C = \emptyset$$
6. Let $P = \{a, b\}$, $Q = \{1, 2\}$, and $R = \{2, 3\}$. Find each of the following sets:
 - a) $P \times (Q \cup R)$
 - b) $(P \times Q) \cup (P \times R)$
7. Given the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and sets $A = \{2, 4\}$, $B = \{1, 2, 8\}$ and $C = \{1, 2, 5, 6, 10\}$, find each of the following:
 - a) $A \cap C$
 - b) $A \cup B$
 - c) $B - C$
 - d) C'
 - e) $|C|$
 - f) $A \times B$
 - g) $P(B)$

8. Let $U = \{0, 1, 2, 3, 4, 5, 6\}$. Match each of the sets on the left with the appropriate set on the right. Not every set on the right will be used.

a) $\{2k+2 : k \in U\}$	[]	(A) $\{-2, 2, 6, 10, 14, 18, 22\}$
b) $\{2m : m \in U\}$	[]	(B) $\{0, 4, 8, 12, 16, 20, 24\}$
c) $\{n : n-2 = 4L \text{ for some } L \in U\}$	[]	(C) $\{4, 8, 12, 16, 20, 24, 28\}$
d) $\{4p : p \in U\}$	[]	(D) $\{0, 2, 4, 6, 8, 10, 12\}$
		(E) $\{2, 6, 10, 14, 18, 22, 26\}$
		(F) $\{2, 4, 6, 8, 10, 12, 14\}$

9. Let $U = \{a, b, d, e, f\}$, $A = \{a, d, f\}$, $B = \{b, e\}$ and $C = \{e, f\}$ be sets, verify

$$A \times (B - C) = (A \times B) - (A \times C)$$

10. In a fruit feast among 200 students, 88 chose to eat durians, 73 ate mangoes, and 46 ate rambutans. 34 of them had eaten both durians and mangoes, 16 had eaten durians and rambutans, and 12 had eaten mangoes and rambutans, while 5 had eaten all 3 fruits. Determine, how many of the 200 students ate none of the 3 fruits, and how many ate only mangoes?

11. Simplify the following

$$(a \cap (a \cap b)') \cap ((a \cap b)' \cap b)$$

12. Given set $A = \{s, t, r, u, c, r, e\}$. Answer the following questions:

- Find $|A|$
- List the elements of set $B = \{x | x \in \{a, e, i, o, u\} \text{ and } x \in A\}$
- List the subset of set $C = \{m, h\}$

13. State whether the following is TRUE or FALSE

- $3 \notin \{x | x \text{ is an even number}\}$
- $\{a\} \subseteq \{a, b, c\}$

14. Let $U = \{1, 2, 3, 4, 5, 6, 7\}$ and $A = \{3, 4, 5, 6, 7\}$ $B = \{1, 3, 5\}$. Show that:

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

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

15. Find the cartesian product of set $P = \{b, c\}$ and $Q = \{1, 2\}$

16. Prove that $(P' \cup Q)' \cap P' = \emptyset$ using properties of set

17. Prove that $((P \cup Q) \cup Q)' = P' \cap Q'$ using properties of set.

18. Prove that $((P \cup Q) \cap Q')' = P' \cup Q$ using properties of set.