CHAPTER 1 SETS

Learning outcomes

At the end of this chapter, Learners will:

- Interpret the set builder notation; {x: x > 2, x ∈ Z}.
- Find the intersection set involving up to 3 sets.
- Interpret the set complement including its symbol (i.e. A', B')
- Use single set operation symbols (e.g. A∪B∪C or A∩B∩C).
- Use combined set operation symbols [e.g. (A∪ B') ∩ C, (A' ∩ B) ∪ C, A'∩(B' ∪C)]
- Apply simple operations on sets.

CONCISE INFORMATION

Set Builder Notation

(a) Given that $P = \{3, 4, 5, 6, ...\}$, write P as a set builder notation and describe the set builder notation in words.

Solution

$P = \{x: x > 2, x \in \mathbb{W}\}$ and is read as:

"P is a set of x , such that x is greater than 2 and x is a member of whole numbers "

(b) Given that $Q = \{x: x \geq 4, x \in \mathbb{N}\}$

(i) Describe set Q in words

(ii) List the elements in set Q.

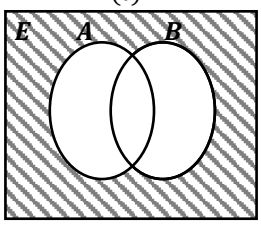
Solution

(i) " Q is the set of x such that x is greater than or equal to 4 and x is a member of Natural numbers "

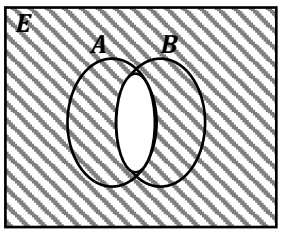
(ii) $Q = \{4, 5, 6, 7, 8, 9, 10, ...\}$

(c) Write down the set notation of the shaded regions in the following Venn diagrams

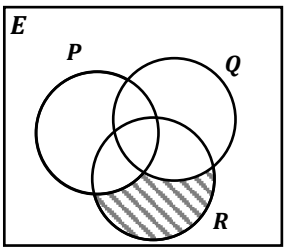
(i)



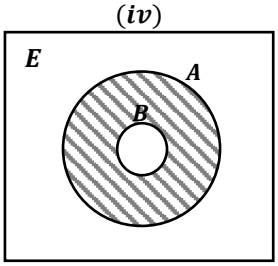
(ii)



(iii)



(iv)



$(i)\ (A \cup B)'$ $(ii)\ (A \cap B)'$ $(iii)(P \cup Q)' \cap R$ $(iv)B' \cap A$

Intersection Set *(involving up to 3 sets)*

Given two non-empty sets A and B, the intersection set of A and B is a set of elements which belong to both set A ***and*** set B.
The intersection of sets can also be defined on three sets: sets A, B and C.
If sets A and B are disjoint (i.e no elements common to A and B) then their intersection is empty. i.e. $A \cap B = \emptyset$ or $A \cap B = \{\ \}$

Example

Given that $A = \{1, 2, 4, 5\}$, $B = \{2, 4, 6, 7\}$ and $C = \{2, 3, 5, 7, 8\}$.
The intersection of A, B and C is a set of elements common to all the three sets.
$A \cap B \cap C = \{2\}$

Set Complement

Given a universal set E and a subset set A, the complement of A denoted by A' is a set of elements belonging to E but outside of set A.

Example

Let E = {a, b, c, d, e, f, g} be a universal set and B = {b, c, f} be a subset of E.
Then the complement of set B is $\boldsymbol{B'}$ **= {a, d, e, g}**

Single Set Operation

Single set operation involves one operation of either intersection or union (*of three or more sets including the complement of a set*) or intersection of two or more sets.

Example

Given that $A = \{1, 2, 4, 5\}$, $B = \{2, 4, 6, 7\}$ and $C = \{2, 3, 5, 7, 8\}$.
The union of A, B and C is the set consisting of all elements belonging to A, B and C.
i.e.: $A \cup B \cup C$ = {1, 2, 3, 4, 5, 6, 7, 8}

Combined Set Operation

Combined set operations involve intersection, union and/or complement of a set on three or more sets.

Example

Let E = {a, b, c, d, e, f, g} be a universal set and, A = {a, b, c}, B = {c, f} and C = {a, c, e} be three subsets of E. Find $A \cup B \cup C'$.

Solution

Since set A and set B are obvious we first determine the complement of C, C'.
If C = {a, c, e} then C' = {b, d, f, g}
$A \cup B \cup C'$ = {a, b, c, d, f, g}

Set Notation

Given that E is universal set and, sets A, B and C are subsets of E then:
(i) $A \cap E = A$
(ii) $A' \cap E = A'$
(iii) $B \cup E = E$
(iv) $A \cap B = A$ if A is a subset of B
(v) $A' \cap B' = B'$ if A is a subset B
(vi) $A \cup B \cup C$ is a subset of E