

Q1. If $a \in A$ and $A \subseteq B$ is it necessarily true that $a \in B$?

Q2. If $A = \{1, 2, \{1\}, \{2, 3\}\}$ then which of the following are true or false.

- i. $1 \in A$.
- ii. $\{1\} \in A$.
- iii. $2 \subset A$.
- iv. $\{1\} \subset A$.
- v. $3 \in A$.
- vi. $\{1, 2\} \subset A$.
- vii. $\{2, \{2\}\} \subset A$.
- viii. $\{2, \{1\}\} \subset A$.
- ix. $\{1, \{1\}\} \subset A$.

Q3. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and let

$$\begin{array}{lll} A = \{1, 2, 3, 4, 5\}, & B = \{4, 5, 6, 7\}, & C = \{5, 6, 7, 8, 9\}, \\ D = \{1, 3, 5, 7, 9\}, & E = \{2, 4, 6, 8\}, & F = \{1, 5, 9\} \end{array}$$

Find each of the following (note that all complements should be taken relative to U):

- i. $A \cup B$
- ii. $A \cap B$
- iii. $A \cup C$
- iv. $A \cap C$
- v. $D \cup F$
- vi. $D \cap F$
- vii. A^C
- viii. B^C
- ix. D^C
- x. E^C
- xi. $A - B$
- xii. $B - A$
- xiii. $D - E$
- xiv. $F - D$
- xv. $A \Delta B$
- xvi. $C \Delta D$
- xvii. $E \Delta F$

Q4. The set $\mathbb{N} = \{1, 2, 3, \dots\}$ is the set of positive integers. List the members of the following subsets of \mathbb{N} .

- i. $A = \{x \in \mathbb{N} : 3 < x < 9\}$
- ii. $B = \{x \in \mathbb{N} : x \text{ is even, and } x < 11\}$
- iii. $C = \{x \in \mathbb{N} : 4 + x = 3\}$

Q5. If $A = \{3, 4, 7, 9, -1\}$, $B = \{1, -1, 15, 3\}$ and $C = \{3, 4, 5, 6, 7, 8, 9\}$ then what is

- i. The complement of A in B .
- ii. The complement of B in A .
- iii. The complement of $A \cap B$ in C .
- iv. The complement of $A \cup B$ in C .
- v. The complement of $A - B$ in C .
- vi. The complement of $B - A$ in C .

Q6. Give an example of three sets A, B and C for which $A - (B - C) \neq (A - B) - C$. We say that set difference isn't associative.

Q7. Explain why $A = (A - B) \cup (A \cap B)$ is always true for any two sets A and B .

Q8. Determine the power set of $A = \{a, b, c, d\}$.

Q9. Consider the sets

$$\begin{array}{lll} A = \{1, 2, \dots, 9\}, & B = \{2, 4, 6, 8\}, & C = \{1, 3, 5, 7, 9\}, \\ D = \{3, 4, 5\}, & E = \{3, 5\} & \end{array}$$

Which of these sets could substitute for the set X in each of the following conditions:

- i. $X \cap B = \emptyset$
- ii. $X \subseteq D, X \not\subseteq B$
- iii. $X \subseteq A, X \not\subseteq C$
- iv. $X \subseteq C, X \not\subseteq A$

Q10. For each of the following pairs of sets write down the Cartesian product $A \times B$

- i. $A = \{1\}, B = \{2, 5\}$
- ii. $A = \{1\}, B = \{-2, 7\}$
- iii. $A = \{2, 4\}, B = \{1, 9\}$
- iv. $A = \{1, 2\}$ and $B = \{a, b, c\}$

Q11. What do you think should be the Cartesian product if one of the sets is the null set \emptyset ?

Q12. If $A = \{2, 4\}$ and $B = \{1, 9\}$ what is $B \times A$? Compare the results with Q6 part (iii). What do you conclude?