

Subsets, Power Set, Set Operations

1. Definitions

(a) The set B is a **subset** of the set A if(b) The **power set** of a set A is(c) The **union** of sets A and B is(d) The **intersection** of sets A and B is(e) The **difference** of sets A and B (f) The **complement** of the set A is

2. Let $C = \{1, 2, 3\}$

(a) List all the elements of the set C .

(b) List all the subsets of the set C .

(c) Find $\mathcal{P}(C)$. (You have permission to answer this by small changes to your answer in (b).)

(d) Find $\mathcal{P}(\emptyset)$.

3. Determine whether each statement below is true or false and be prepared to give a reason for your answer.

(a) $a \in \{a, b, c, d, \{a\}, \{a, e\}\}$

(b) $a \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(c) $\{a\} \in \{a, b, c, d, \{a\}, \{a, e\}\}$

(d) $\{a\} \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(e) $\{\{a\}\} \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(f) $\emptyset \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(g) $\emptyset \in \{a, b, c, d, \{a\}, \{a, e\}\}$

(h) $\{a, e\} \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(i) $\{\{a, e\}\} \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

(j) $e \in \{a, b, c, d, \{a\}, \{a, e\}\}$

(k) $\{e\} \subseteq \{a, b, c, d, \{a\}, \{a, e\}\}$

4. Let $A = \{(x, y) \in \mathbb{R}^2 : x^2 + y^2 \leq 1\}$ and let $B = \{(x, y) \in \mathbb{R}^2 : x \leq y\}$. Suppose the universal set U is $\mathbb{R} \times \mathbb{R}$. Sketch each of the following on separate axes.

(a) A (f) $B - A$ (b) B (g) \overline{A} (c) $A \cup B$ (h) $A - \overline{B}$ (d) $A \cap B$ (i) $\overline{A - B}$ (e) $A - B$ (j) $\overline{A \cup B}$

5. How many subsets does $D = \{1, 2, 3, 4, 5\}$ have? Justify your answer.

6. Determine $|\mathcal{P}(A)|$ where A is a set with n elements.