
Section 1.3: Operations on Sets

Exercises

Let $A = \{ x / x \text{ is an even natural number} \}$ and $B = \{-1, 0, 1\}$. Are the following statements T (true) or F (false)?

1. $A \cap B = \{0\}$
2. $B \cup \mathbb{N} = \{-1, 0, 1, \dots\}$
3. $B \subseteq \mathbb{Z}$
4. $\emptyset \subseteq A$
5. $\mathbb{Z} \cap \mathbb{N} = \mathbb{Z}$
6. $B \cap A = B \cap \mathbb{N}$
7. $0 \in A$
8. $\emptyset \cup A = A$
9. $\emptyset \cup \mathbb{Z} = A \cap B$

Let $D = \{3, 5, 7\}$, $E = \{2, 4, 6, 8\}$, and $F = \{1, 2, 3, 4, 5\}$. Find the following sets.

10. $D \cup \emptyset$
11. $D \cup E$
12. $D \cap F$
13. $F \cup \mathbb{N}$
14. $(D \cap F) \cup E$
15. $(D \cap E) \cup F$
16. $(E \cup F) \cap \emptyset$
17. $D \cup (E \cup F)$

18. $D \cap (E \cap F)$

19. $((E \cup F) \cap (E \cup F)) \cap \emptyset$

Consider the same sets $D = \{3, 5, 7\}$, $E = \{2, 4, 6, 8\}$, and $F = \{1, 2, 3, 4, 5\}$. Use one of the symbols \in , \subseteq , $=$, \cup , or \cap in the following blanks to make the statements correct.

20. E _____ $\{x \mid x \text{ is an even natural number}\}$

21. $D \subseteq (F$ _____ $Z)$ (note: must use \cup or \cap here so that the right-hand side is a set)

Consider the sets $A = \{2, 4, 6\}$, $B = \{3, 4, 5\}$, $C = \{x \mid x \text{ is an even natural number less than } 10\}$, and the universal set $U = \{1, 2, 3, \dots, 10\}$. Find the following sets.

22. \overline{A}

23. \overline{C}

24. $C \cup \overline{B}$

25. $\overline{A} \cup \overline{B}$

26. $\overline{B} \cap U$

27. $\overline{A} \cup U$

28. $\overline{A \cup B}$ -- this means take $A \cup B$ and then negate the result (do you get the same result as question #25?)

29. $(\overline{A} \cap B) \cup A$

30. $\overline{C \cup \overline{C} \cup \overline{B} \cup \emptyset}$

Consider the sets $C = \{x \mid x \text{ is an odd natural number}\}$, $D = \{x \mid x \text{ is an odd integer}\}$, $E = \mathbb{N}$, and the universal set $U = \mathbb{Z}$. Find the following sets.

31. \overline{D}

32. $C \cup \emptyset$

33. $C \cup D$

34. $C \cap \overline{E}$

35. $\bar{E} \cap U$

36. $\bar{E} \cup \emptyset$

Consider the sets $A = \{x \mid x \text{ is an odd natural number}\}$, $B = \{1, 3, 5\}$, and $C = \{2, 4, 6\}$.
Are the following true or false?

37. $A = (1, 2, 3, \dots)$

38. $B \in A$

39. $5 \subset A$

40. $B \cap C = \{\emptyset\}$