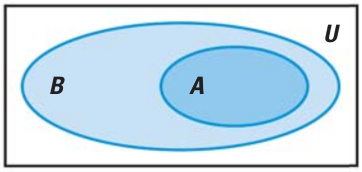
SUBSETS If every element of a set A is also an element of a set B, then A is a **subset** of B. This relationship is written as $A \subseteq B$. For any set A, $\emptyset \subseteq A$ and $A \subseteq A$. In the diagram at the right, A is a subset of B.



EXAMPLE 2 Identify subsets

Let $A = \{-2, 1, \sqrt{3}, \pi\}$, $B = \{1, \pi, 5\}$, and $C = \{-2, 1, 3, \pi, 5\}$.

a. Is $B \subseteq A$? **b.** Is $B \subseteq C$? **c.** Is $C \subseteq (A \cup B)$?

Solution

a. Not every element of B is an element of A, because 5 is not an element of A. So, B is *not* a subset of A.

b. Every element of B is an element of C. So, B *is* a subset of C.

c. Note that $A \cup B = \{-2, 1, \sqrt{3}, \pi\} \cup \{1, \pi, 5\} = \{-2, 1, \sqrt{3}, \pi, 5\}$. Not every element of C is an element of $A \cup B$, because 3 is not an element of $A \cup B$. So, C is *not* a subset of $A \cup B$.

PRACTICE

EXAMPLE 1 on p. 715 for Exs. 1–8

OPERATIONS ON SETS **Let U be the set of all whole numbers from 1 to 20. Let $A = \{2, 3, 5, 7, 11, 13, 17\}$, $B = \{1, 4, 9, 16\}$, and $C = \{2, 5, 8, 11, 14, 17, 20\}$. Find the indicated set.**

1. $A \cup B$
2. $A \cap B$
3. $\overline{A}$
4. $\overline{B}$
5. $A \cup B \cup C$
6. $\overline{A} \cap C$
7. $\overline{C \cup B}$
8. $B \cup (A \cap C)$

EXAMPLE 2 on p. 716 for Exs. 9–12

SUBSETS **Let $A = \{-5, \pi, 10\}$, $B = \{-5, 1, \sqrt{5}, 10\}$, and $C = \{-5, 2, \pi, 10\}$.**

9. Is $A \subseteq B$?
10. Is $A \subseteq C$?
11. Is $(A \cap B) \subseteq C$?

12. **REASONING** List all the subsets of the set $A = \{-2, 4, 9\}$.

OPERATIONS ON SETS **Consider the sets defined below. Find the indicated set.**

U = the set of all 12 months
X = the set of all 30 day months
Y = the set of all 31 day months
Z = the set of all months ending with "r"

13. $X \cup Z$
14. $X \cap Y$
15. $\overline{Z}$
16. $\overline{X \cup Y}$

17. **REASONING** Is the set of all irrational numbers a subset of the real numbers? of the integers? *Explain.*

18. **RADIO** Two radio towers are set up at points A and B on the map at the right. Each radio tower has a signal that can reach towns up to 50 miles away. Find the set of all towns that can receive a signal from both of the towers.

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